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ABSTRACT

This monograph describes 30 college and university programs funded by the Fund for the Improvement of Postsecondary Education from 1989 to 1991. Each description includes information on program purpose, project activities, major insights and lessons, project continuation, and available information. The first group of 10 are programs focused on assessment and include an assessment resource center, area concentration achievement testing with curricular evaluation, computers and college writing, assessment seminars, New Pathway Curriculum impact evaluation, liberal education model assessment, college-wide measures toward general education goals, comprehensive assessment in academic disciplines, and a regional assessment network. Another group of four programs address college teaching: professional development, medical scholars, and database and online service orientation. Nine projects address curriculum and teaching in the disciplines including laboratory education, undergraduate mathematics, economic curricula, scientific thinking, French language and culture, case study physics, music theory, biology instruction, and freshman chemistry. Two programs address general education. Three projects involve teacher education and two programs address ethics instruction. The following institutions are included: University of Tennessee; Austin Peay State University (Tennessee); City University of New York; Harvard University (Massachusetts); Miami University (Florida); State University of New York; Winthrop College (South Carolina); University of California; Ohio State University; Salem State College (Massachusetts); Clemson University (South Carolina); Denison University (Ohio); Dickinson College (Pennsylvania); Tufts University (Massachusetts); University of Maryland; New Mexico State University; Northwestern University (Illinois); University of Oregon; University of Rhode Island; University of North Texas; Indiana University of Pennsylvania; Northern Virginia Community College; Union College (New York); University of Connecticut; and Saint Cloud State University (Minnesota). (JB)

ED 364 159

LESSONS LEARNED FROM FIPSE PROJECTS II

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Fund for the Improvement of Postsecondary Education
U.S. Department of Education

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Lessons Learned
FROM
FIPSE Projects II

Dora Marcus
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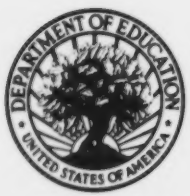
Written in Collaboration with 30 Directors of College and University Reform Projects Who Tell What Worked, What Didn't, and Why

Preface by:
Charles H. Karelis
Director

Fund for the Improvement of Postsecondary Education
U.S. Department of Education



September 1993

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In the mid 1980's, institutions were struggling in isolation with state accountability mandates, accrediting agency requirements, and internal concerns with declining student performance. FIPSE funded these two projects to make available expertise and resources on assessment to national and international audiences, and to foster and publicize advances in the field.

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PACAT is a consortium-based assessment program designed to bridge the gap between homegrown tests and nationally-normed examinations. It does this by linking multiple-choice standardized tests to departmental curricula and making them faculty-owned. The area concentration tests (ACATs) were constructed as exit exams for graduating seniors, but also as a way to promote curricular reform within disciplinary departments. By the end of the three-year project, approximately 5,000 ACATs had been administered in 19 states in 54 departments.

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25. **The State University of New York College at Buffalo: Critical Inquiry Studies for the General Undergraduate Population** 161

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28. **Union College: Introducing Teacher Education to a Liberal Arts Campus–A Model for Integration with the Disciplines** 177

Pre-professional programs at liberal arts colleges, and especially teacher education programs, are frequently viewed as marginal to the mission of the institution. The Educational Studies Program at Union was deliberately structured to become integrated with the liberal arts curriculum and attract faculty commitment and support.

VII. **ETHICS** 183

29. **University of Connecticut Health Center: Improving Hospital Ethics Committees** 185

Concern that increases in the scope and complexity of modern medicine might overwhelm patient decision-making has led to the widespread introduction of Hospital Ethics Committees (HECs). This project developed, piloted, and evaluated a week-long ethics and law curriculum for HEC members.

30. **St. Cloud State University: Responsibility in Professional Life** 191

Weak grasp of or lack of concern for professional ethics among many college graduates has produced a call for instruction in this subject. This project devised strategies for preparing faculty to introduce cases in ethics into courses in a full range of professional programs in the University. Using practicing professionals as consultants yielded especially good results.

PREFACE

The Fund for the Improvement of Postsecondary Education--FIPSE to its friends--supports pilot tests of new ideas in postsecondary education. This volume describes some interesting campus experiments whose support from FIPSE ended between 1989 and 1991. In addition, the volume attempts to draw usable conclusions, asking what worked, what didn't work, and why. It has been designed to help American colleges and universities facing issues similar to those that faced the directors of these projects. Among the issues:

- how to assess student learning objectively while protecting faculty ownership of the assessment process;
- how to use computers in college teaching;
- how to broaden professional education;
- how to raise minority--and majority--achievement in math and science;
- how to integrate teacher education into a liberal arts curriculum.

This book is the second in a series. In October of 1990, when the first volume of Lessons Learned from FIPSE Projects appeared, the entries on the various projects were described as project self-portraits polished by FIPSE staff. The same applies this time around. Of course that is not to say that FIPSE staff helped the project directors paint their work in favorable colors. It means that while the entries rest ultimately on outcomes data supplied by the project directors

themselves, FIPSE staff helped to elicit important facts from the project directors by posing hard questions, and FIPSE staff drafted the entries. The leader of this rather complex undertaking has been Dr. Dora Marcus, FIPSE's specialist in project evaluation.

But the differences between this monograph and its predecessor are significant. This volume harvests the first generation of FIPSE projects which had been consciously designed from the outset **to be evaluable,** FIPSE having boosted its commitment to evaluation in 1986. Hence the following accounts of what did and did not work are more thorough than some of those in Lessons Learned I. A second difference is the number of projects described--30 rather than 15, with especially strong groupings in the areas of assessment and computer assisted instruction.

The temptation to draw lessons from the process of drawing lessons about postsecondary education must be resisted. (What would come next, after all?) Still, several things strike an observer. First, it is notable how powerful good outcomes data can be in selling other practitioners on a given innovation, once those practitioners are persuaded of a need. Rhetoric may be the key to raising consciousness about a certain academic problem or issue, but it is the innovator armed with figures who wins support for a particular solution. On the other side, however, it is puzzling how slow many postsecondary educators are to compile evidence about what works in teaching and learning, considering the stress they typically lay on evidence in their scholarly work.

Last, in the midst of this case for drawing and sharing the lessons of reform, a note of caution. Paradoxically, it might be wise to reinvent some kinds of wheels on every campus, rather than learning directly from the achievements of others. One thinks, for example, of

general education curricula. Local wrangling about the content of the general education curriculum may play an important role in the professional development of the academic community, and the resulting sense of local ownership may be crucial in motivating faculty to take on what are often seen as less glamorous teaching assignments. That the particular content of the general education curriculum at a campus may in fact have little impact on the kinds of intellectual growth most people care about (see below, p.38) makes this seem less paradoxical.

The project-portraits that follow are of course mere sketches. But all of our former project directors have indicated their willingness to fill in details, and they will welcome calls from readers of this monograph who have been intrigued or inspired by what they read here.

Charles H. Karelis, Director
Fund for the Improvement of Postsecondary Education

ASSESSMENT

FIPSE has had an interest in assessment from the time of its founding. Of the 89 projects the Fund supported in its first round of grants in 1972, 15 concerned assessment of student learning outcomes. By 1990, 29 Comprehensive Program projects involved assessment.

The ten successful programs described here range from large international conferences to particular projects in individual institutions. The prevalence of consortial projects and other kinds of large scale activities in this area provides a notable contrast with other program areas, where individual institutional activity is the rule. This phenomenon can be attributed to a variety of causes, including pressures from state legislatures and regional accrediting agencies, the manifest advantages of pooling experience in an area where strategy and technique are just beginning to develop, and the need to have a larger number of students with whom to validate outcome measurements than a single institution can provide.

The last two of these problems becomes particularly acute in the case of particular disciplines. Here even consortial arrangements, while solving the problem of having a sufficiently large pool of students, run up against the problem of differences of approach and emphasis from one participating department to another.

These programs illustrate a rich variety of assessment strategies and instruments. Departing from early efforts that relied on input factors, nationally normed tests and quantifiable outcomes like graduation rates and alumni satisfaction, the new assessment programs look at specific performance outcomes. Tests are likely to be faculty-made and tailored to measure success in achieving precisely defined

learning goals. Comparative assessments are well controlled, use statistics carefully and employ a variety of assessment strategies.

For all the technical care that has gone into developing these assessment projects, conclusive demonstration of the degree and full extent of student learning as a result of a specific activity remains elusive. At present, it is not possible to measure all aspects of student learning, since only a few instruments can demonstrate differences that are both conclusive and substantial. The problem is compounded by the cumbersome logistics of following students for long enough to assess the full effects of their educational experiences and ensuring their participation in assessment activities in which they have no personal stake.

The proliferation of assessment programs further suggests a need, not directly addressed by these projects, to develop ways to assess assessment. As outcome assessments become a common feature of the higher education landscape, FIPSE will expect to see more effort in this direction.

BUTTRESSING ASSESSMENT

AAHE's Assessment Forum
The University of Tennessee, Knoxville's Assessment Resource Center

Purpose

As the assessment movement gathered momentum a decade ago, it became apparent that colleges, universities, and academic departments across the nation would need help learning the rudiments of assessment and making plans to evaluate their programs. Since there existed no resource centers dedicated to assessment, and no bibliographies or directories, institutions that had emerged as leaders in the field, such as Alverno College, Northeast Missouri State University, Miami-Dade Community College and the University of Tennessee, Knoxville, were overwhelmed with requests for guidance and information.

In 1986 FIPSE funded two projects designed to share expertise and resources on assessment with national and international audiences, and to foster and publicize advances in the field: the University of Tennessee, Knoxville's Assessment Resource Center, and the Assessment Forum of the American Association for Higher Education. During the three years that followed, the men and women who staffed these projects answered thousands of inquiries, presented and published scores of papers and reports, and organized conferences and workshops whose principal problem became how to accommodate the escalating numbers of participants. These efforts to inform, assist, and guide the dialogue on teaching and learning have helped to revitalize undergraduate education on many campuses in recent years.

Project Activities

From the 1990's vantage point, it is difficult to envision the assessment field, and indeed higher education, without AAHE's Assessment Forum and The University of Tennessee, Knoxville's (UTK) Assessment Resource Center. In the mid-1980's, however, colleges and universities were struggling in isolation with state accountability mandates, accrediting agency requirements, and internal concerns with declining student performance and the efficacy of the curriculum. The only help available came from word of mouth, impromptu exchanges, and serendipitous discoveries in the library.

Thus, the logical beginning for both AAHE and UTK was to gather in a systematic fashion the information on assessment that was dispersed throughout the country. Accordingly, the staff of the Assessment Forum and the Assessment Resource Center set about commissioning and writing papers, visiting campuses, and organizing workshops to learn about and contribute to efforts across the nation.

The volume of the dissemination activities undertaken by these projects explains their emergence as major forces in assessment. Over a three-year period, UTK's Assessment Resource Center produced eight major reference works, 19 research reports, an international conference, a consortium of campus-based leaders, a cross-national study of assessment, several assessment bibliographies, and a national newsletter--Assessment Update, published by Jossey-Bass, the first newsletter dedicated to assessment in postsecondary education. It provided services to campuses in 49 states plus D.C. and Puerto Rico and five foreign countries through workshops and visits, and sent materials to 1400 colleges, universities and organizations.

Between 1986 and 1989 AAHE's Assessment Forum distributed approximately 30,000 resources to individuals and organizations. The Forum compiled available literature, commissioned and produced a series of papers (now in second printing) on various aspects of assessment, published a directory of outstanding assessment projects and organized annual conferences that drew close to 3,000 people. AAHE's own publications helped to spread the word. Two issues of the AAHE Bulletin focused on assessment, and Change magazine became a major vehicle for news and reflection on the field, especially the award-winning article in the October, 1990 issue on assessing assessment.

Major Insights And Lessons Learned

The work of these two centers was not simply dissemination, however. Both were actively engaged in research and analysis as well, attempting to identify lessons and trends in assessment. Their findings include the following:

o The workshops, readings, arguments and meditations of the last half decade have not been in vain. The higher education community has grown increasingly sophisticated about assessment. For example, the audiences of the early AAHE assessment conferences manifested above all an urgent desire to understand assessment so as to ward off its anticipated dangers. Within a year or two, however, attendees began to express a need for guidance in their search for the best models. Eventually, based on their own experience, faculty and administrators undertook a quest for alternatives to standardized instruments. At present, there is a new sense of confidence with respect to assessment on the part of higher education professionals, and a concern with keeping assessment

connected to the classroom and making maximum use of its educational potential.

o The profession's preferences regarding instruments of assessment have also shifted. An early interest in standardized tests and external examiners has given way to exploration of alternative approaches such as self-assessment, portfolios, and interviews, brought on in part by an awareness of the diversity of institutional cultures and the importance of ensuring faculty commitment.

o Finally, as the field has matured, interest has inevitably moved towards assessing assessment. What effect is this massive effort having on what students learn? On campuses that have engaged in assessment, faculty are more likely to think about teaching in terms of student learning. Some are lecturing less and asking students to write more. There is a new willingness to experiment with technology for teaching and testing. Most importantly, one sees an emerging sense of faculty and institutional responsibility for student learning, and a commitment to monitoring and improving what students know and can do. In institutions where assessment is valued and experimented with, the conversation about teaching and learning has gained in intensity and sophistication, and ultimately students are bound to profit. As yet, though, the causal link between assessment and student learning has not been clearly established.

The ever increasing requests for information and the overflowing audiences at national and international workshops testify to the conviction in the higher education community that assessment, directly or indirectly, benefits what and how much students learn. The most obvious sign of assessment's grip on the academic consciousness is that

at present both AAHE's Assessment Forum and UTK's Assessment Resource Center are not only continuing but expanding their work.

Project Continuation

UTK's Assessment Resource Center has been institutionalized by the University as the Center for Assessment Research and Development. The Center has sponsored a survey administered by six Tennessee institutions to employers of their graduates, and a study of possible adaptations of W. Edwards Deming's quality improvement philosophy to higher education. FIPSE is now also funding an Assessment Clearinghouse at UTK to evaluate and disseminate assessment instruments and methods.

The AAHE Assessment Forum has completed a second 3-year cycle which included, among other activities, the formation of an "Assessment Leadership Council." This group of practitioner-scholars examined research and development issues such as training materials, the relationship between assessment and accreditation and the role of assessment in pre-collegiate reform. A document entitled "Statement of Principles of Good Practice for Assessing Student Learning" was developed by this group. Printed copies of the Statement are available free (thanks to the Exxon Foundation) in packets of 25 from AAHE. AAHE has com- mitted itself to continuing the Assessment Forum with its own funds.

The AAHE and UTK initiatives were prompted by an overwhelming need on the part of the higher education community at the inception of the assessment movement. Seven years later the clamor for guidance and information, far from abating, resounds abroad as well as throughout this country. Assessment has raised questions about

teaching and learning that will stimulate and inform the international academic dialogue well into the 21st century.

Available Information

For further information about AAHE's Assessment Forum, write to:

Karl Schilling, Director
AAHE Assessment Forum
One Dupont Circle, Suite 360
Washington, DC 20036-1110
202-293-6440

Previous AAHE Forum Directors under FIPSE funds are:

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Department of Modern and Classical Languages
University of Connecticut
U-57
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203-486-1531

Pat Hutchings, Director
AAHE Teaching Initiative
American Association of Higher Education
One Dupont Circle, Suite 360
Washington, DC 20036-1110
202-293-6440

For further information about UTK's Assessment Resource Center, write to:

Trudy W. Banta
Vice Chancellor for Planning and Institutional Improvement
Indiana University - Purdue University at Indianapolis
140 Administration Building
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Indianapolis, IN 46202
317-274-4111

AUSTIN PEAY STATE UNIVERSITY

Project for Area Concentration Achievement Testing (PACAT): Curricular Evaluation

Purpose

In recent years many institutions have found that national achievement tests were poorly suited to curriculum improvement within academic departments. Typically, national testing instruments are not adapted to the goals and content emphases of particular disciplinary departments, and cannot gauge the impact of the curriculum on student learning. On the other hand, the validity of "in-house" tests, internally normed and tailored to individual departmental needs, cannot be judged against external criteria.

The Project for Area Concentration Achievement Testing (PACAT) responded to this need for assessment in the major that is sensitive both to department characteristics and curriculum, and to the need to compare student performance across peer institutions. Begun in 1983 as a consortium of Tennessee psychology departments, it aimed to expand and disseminate its assessment model in psychology, political science, and social work to include faculty in nine other states and create a minimum of six additional disciplinary consortia.

Innovative Features

PACAT surveys were used to identify content area emphases of departments in each discipline. Then assessment instruments for

graduating seniors were constructed to conform to these curricular patterns from items submitted by faculty at participating institutions.

By giving faculty ownership of multiple-choice standardized testing and by measuring the relationship between content area performance and departmental curricula, PACAT bridges the gap between parochial instruments and nationally-normed exams. PACAT creates, maintains, and updates test items and serves as a coordinating office for scoring and interpreting the summary test results to departments. Score reports generated by PACAT contain raw and standardized scores for each content area tested and the individual department's performance history.

These senior tests have been used to meet state-mandated assessment requirements. Since they point out the academic weaknesses and strengths of graduating students, individual departments can alter course content and balance course requirements in line with test results. Further, departments can evaluate the impact of their curriculum on student achievement against other campus departments and against their own performance in previous years.

Evaluation

Several construct validation studies of the Area Concentration Achievement Test (ACAT) in psychology were conducted by independent evaluators and by faculty at adopting institutions; that is, evaluators examined the extent to which inferences and decisions derived from test scores were supported by evidence and rationale. Comparison of groups of introductory and senior students showed seniors' test performance to be superior on all subtests and on overall scores. The ACAT was thus demonstrated to be psychometrically

sound and to measure what it was designed to measure--the impact of the psychology curriculum on student majors. Also, reliability statistics were collected at each test administration by using multiple versions of the test and separate groups of participating students.

Evaluation of PACAT shows that the project exceeded its objectives in the following areas: number of curriculum surveys returned; number of follow-up requests; number of ACAT instruments administered annually; number of disciplines and curricular patterns used by ACAT; number of institutions and states added to the consortia; and test items added to item pools used to construct ACAT instruments.

When FIPSE funding began in 1988, 865 ACATs had been administered in 22 departments during a five-year period, mostly in Tennessee. By 1992, 5,267 ACATs had been administered in 54 departments in 19 states. Curriculum surveys were sent to 10,600 academic departments nationally and over 4,700 were returned in 13 disciplinary areas. Follow-up surveys were requested by 1,394 departments. The Educational Testing Service contributed to PACAT a large pool of items gathered under another FIPSE-funded project.

Beyond the three original ACAT disciplines, new instruments have been introduced in English literature, communications, art, biology and agriculture. Five new curricular versions of the ACAT in psychology and two in biology have been adopted for use. New multi-state consortia are being formed in history, public administration and criminal justice.

Of course, the long-term impact of PACAT on students will depend on the extent to which test results are used to improve curriculum and instruction. It is too early to determine this effect definitely, since the

consortia are still forming and it takes several years of data collection before departments are ready to act on the results.

ACAT has already been used to justify program accreditation, perform self-studies and comply with state-mandated assessments. Colleges and universities such as Jamestown College, Belmont College, The University of Alabama, Ohio State University, Wayne State University and East Tennessee State University have used ACAT results to support faculty development, to isolate areas of academic weakness among their graduating students, to readjust curriculum content to balance those weaknesses, to initiate faculty and student research, and to provide external validation to program evaluation of departments and courses.

Project Continuation

Austin Peay continues to support PACAT at levels somewhat higher than those prior to FIPSE, but it must now obtain independent funding for ACAT test materials and administration. Presently, PACAT is continuing its complete program and developing new assessment consortia.

Major Insights and Lessons Learned

Giving individual departments a voice in the construction of tests to evaluate their curricula is a long, slow process, taking at least three or four years to implement programs, many of which then require several years of fine tuning and coordinating efforts with administrators and departmental faculty. Unfortunately, many institutions ignore students while planning assessment, even though that is a time when they could gain their acceptance and cooperation.

PACAT revealed that many departments at small institutions are not able to initiate assessment programs of their own, especially those using external comparisons. By pooling resources and costs through consortia, however, assessment can be performed and the diversity of departmental curricula can be maintained.

Available Information

Information about the surveys, curricular patterns, and the ACATs in specific disciplines is available by writing or calling PACAT. Departments are welcome to join consortia at any time and, although submitting test items is not a requirement, they are encouraged to do so. Upon receipt of a written request, sample test booklets will be provided for examination. Commentaries, both favorable and unfavorable, combined with concrete examples for improvement of the test items, are welcome.

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CITY UNIVERSITY OF NEW YORK

The National Project on Computers and College Writing

Purpose

This evaluation and dissemination project aimed to assess the effectiveness of computer-assisted composition programs and to showcase outstanding college programs that employ this instructional strategy. A network of 15 competitively selected institutions of all sizes and types, chosen from among 90 applicants, participated by joining in a centrally designed assessment program and by sharing their computer-use models and instructional strategies with each other and with wider audiences.

Project Activities

Each of the 15 institutions agreed to carry out an assessment activity according to a common plan. Each site identified at least six sections of English composition, three taught using computer-assisted instruction and three by conventional methods. Each section enrolled similar kinds of students within a single institution, but this was not necessarily the case across institutions. A pre-course and post-course test common to all 15 sites was administered to each student, who in addition completed the Descriptive Test of Language Skills Sentence Structure Subtest and questionnaires regarding attitudes toward writing and writing anxiety. Each participating institution gathered site-specific qualitative data. The final sample consisted of 1,700 students, equally distributed between computer-instructed and regular sections.

The essays were evaluated centrally, all 1,700 holistically and 10% using analytic assessment methods. While overall the holistic scores showed no difference between experimental (computer instruction) and control (traditional instruction) groups, the scores did reveal significant advantages of computer instruction for those in developmental classes, adult learners and community college students. The analytic scoring did show significantly better performance by students in the experimental sections. Students in computer-based classes also showed a significant reduction in writing anxiety as compared with those in the control groups.

The dissemination activities of the project were concentrated in a conference, "Computers and College Writing: Curriculum and Assessment for the 1990's," and a monograph, Computers and College Writing: Selected College Profiles. The conference enrolled 600 participants from North America and Europe in June, 1990 and was followed by additional conferences in fall, 1990 and spring, 1992. The monograph contains accounts of computer-based composition technology and instructional strategies at 49 institutions in the United States.

Innovative Features

The project is unique in its efforts to assess the effects of computer instruction on student learning and attitudes across a large number of institutions of varied size and type. No base of comparable size exists. The project both addressed questions about the value of computer-based composition instruction and created opportunities for the exchange of information about the way computers are being used in many institutions. Thus it provides an experimental base to justify the use of computers in teaching introductory composition courses as well as furnishing practical resources for teachers and institutions.

Evaluation

The assessment plan and its implementation were not themselves the object of independent external evaluation. Project personnel have, however, been careful to point out the problems inherent in carrying out such a study and employing the kinds of assessment described. Specifically, they point to problems inherent in holistic assessment. While the methodology, when used with trained evaluators, works well in handling a large volume of essays, when used in a pre-test/post-test situation it tends to produce a regression (and advancement) toward the mean pattern. To counteract this effect the project used a number of measures of student growth in addition to the essays.

Holistic scoring, in focusing on overall impressions, fails to identify particular advances in student writing, such as organization, copiousness, or stylistic sophistication. For this reason, 10% of the essays were subjected to analytic assessments, which revealed more significant differences between control and experimental groups. This result led project staff to assess the entire sample analytically, an effort still in process.

Project personnel were well aware of the problems inherent in trying to measure gains over a single semester of instruction, but the logistical problems of maintaining contact with students and administer a common assessment some semesters later were impossible to manage.

Project Impact

The number of participants in the conferences sponsored through the project and subsequent to its completion reflects its far-reaching

effects. Project activities and results have also become known through numerous articles written and produced by project personnel.

The project has produced a firmly established network of institutions engaged in computer-based instruction, and a data base of both institutional strategies and assessment results. This information is a valuable resource for colleges and universities to justify purchase of computers for composition instruction and for those seeking information on the technology, models and strategies of such instruction.

Unanticipated Problems

Apart from the difficulties in finding fully satisfactory and manageable assessment mechanisms, which were acknowledged in advance, the project worked much as planned. Integrating the large volume of information gathered, an effort that continues to the present, required considerably more time and energy than expected.

Major Insights and Lessons Learned

The project has produced convincing evidence of the value of computer-based composition instruction, particularly for less well prepared groups of students.

Project Continuation

In the spring of 1992, the project sponsored "Computers Across the Curriculum: A Conference on Technology in the Freshman Year," which addressed computer-based instruction in a range of introductory college courses.

An effort is now underway to use the project's findings as the basis for a program of technology-driven writing instruction in the New York City Public Schools.

Available Information

The project has generated a number of articles, as well as the major monograph, Computer and College Writing: Selected College Profiles. General information about the project and copies of the publications may be secured by writing to:

Max Kirsh, Director
National Project on Computers and College Writing
Office of Academic Computing
City University of New York
555 W. 57th Street, 14th Floor
New York, NY 10019
212-541-0320

Each of the project sites has developed curricular materials, from videotapes to course syllabi. These are available from the individual institutions or, in some cases, from the project director, who will gladly supply the list of participants.

HARVARD UNIVERSITY

The Harvard Assessment Seminars: Exploration with Students and Faculty about Teaching, Learning, and Student Life

Purpose

The Harvard Assessment Seminars constitute the University's response to President Bok's 1986 call for program assessment designed to lead to policy recommendations. The ongoing Seminars gather 90 faculty and administrators from 15 northeastern colleges, and 60 Harvard graduate and undergraduate students.

Transcending the mere investigation of student knowledge, the Seminars aim to foster curricular and pedagogical experimentation and innovation. Participants congregate in small working groups that include at least one faculty member, one administrator and one student. Each group identifies a project, carries it out and evaluates it.

The groups that met during the 1986-1989 FIPSE grant period examined questions ranging from what undergraduates think makes for a good course or a helpful adviser to how involvement in athletics or employment affects academic performance. Various samples of the undergraduate population were interviewed, and groups of freshmen and upperclassmen were asked to keep time logs of their activities. Harvard and Radcliffe graduates now in their 30's, 40's and 50's were surveyed regarding their opinions of their college experience.

Project Impact

The Seminars' principal achievement has been the creation of an atmosphere of experimentation and innovation in teaching and the curriculum. As a consequence of the Seminars' findings and discussions, faculty are dividing students into small study groups, asking them to write one-minute papers at the end of class, and giving more quizzes and returning them more promptly.

As the project continues, its results will be translated into policy recommendations. In the meantime, assessment has become part of the Harvard campus culture, and the results of the investigations, although they frequently confirm what had already been established by research elsewhere, have been embraced by the faculty because they reflect the immediate campus reality.

Major Insights and Lessons Learned

The surveys and interviews yielded a collection of insights, some large, some seemingly small, but all of them pertinent to the process of teaching and learning. At the prompting of student participants, for example, one group undertook a study of gender differences in the perception of college. Results showed a much greater divergence between the sexes than had been anticipated: male and female students differ in their self-image, in the qualities they seek in their advisors, and in the way their academic performance affects their satisfaction with college. They also study differently: although both men and women (and especially female science students) perform better if they work in groups, women are much more likely than men to study alone.

Students show a high degree of consensus on what makes for a good course: frequent, detailed, punctual feedback that allows for revision. Although involvement in co-curricular activities does not affect academic performance, there is a strong correlation between such involvement and satisfaction with college. The passing decades have little effect on graduates' perception of their college experience: Harvard and Radcliffe alumni in their middle years express much the same views as current undergraduates.

One group's research debunked the venerable myth of faculty inaccessibility. Junior instructors and senior professors alike showed an almost wistful eagerness to meet with students who take even the most modest initiative, and they also turned out to have a lively interest in teaching innovations. Faculty did express reluctance, however, to adopt reforms that would necessitate adding material to already overloaded courses and to incorporate technology without the benefit of proper training.

What can the Seminars teach the higher education community about how best to conduct assessment? At Harvard as on campuses across the nation, faculty involvement--"ownership" of assessment by the men and women who write the syllabi and give the lectures--was the primary factor in success of the Seminars.

Despite the predominance of assessment as a topic of discussion during the last decade, not every academic has a clear idea of its meaning. Especially for faculty at private institutions, assessment carries connotations of standardized all-purpose instruments at best, and state-mandated "gateway" examinations at worst. Thus, it is important that every college define precisely what assessment should mean to its teachers and learners. Harvard faculty chose to extend the concept of assessment beyond simply finding out what students

know, and embraced a philosophy that encourages innovation and creativity both inside and outside the classroom.

Student involvement in assessment can be extremely valuable. Although students initially were not invited to take part in the Seminars, many graduates and undergraduates soon began to manifest a desire to assist in the work. Their collaboration proved providential: they did much of the basic research and statistical work, interviewed their peers, and contributed energy and insights. In exchange they received a modest stipend and an unparalleled opportunity to work in a quasi-collegial capacity with faculty.

The Seminars began in response to presidential interest in assessment, and they would have been unable to continue in the absence of intellectual and financial support from the highest administrative levels. In addition, the Seminars gained impetus from the clear understanding that the various discussions and explorations would result in policy changes that would affect the very core of the educational process at Harvard. This assumption provided the continuing focus for the activities of each group. The mixed composition of the groups--faculty, students and administrators--ensured that the viability of each project was considered hand in hand with its academic merits.

A frequent outcome of the institutionalization of assessment is the creation of a propitious climate for ongoing experimentation, with its attendant disappointments as well as triumphs. This openness to failure as well as success, this acceptance of the inevitable chaotic aspects of intellectual ferment is basic to the proper cultivation of creativity. As the Seminars continue the work of assessment on campus, no deadline is envisioned for their task, for it has become a major thread in the fabric of teaching and learning at Harvard.

Project Continuation

Nourished by the campus climate and spurred by the results of completed projects, the members of the Assessment Seminars continue to engage in various undertakings, many of them designed to put into practice the strategies suggested by the research projects outlined above. Thus, some groups are exploring how to improve advising, especially in view of gender differences. There is interest in promoting faculty-student interaction outside the classroom, and in finding out how faculty can encourage students to take academic risks. Still other participants are investigating how to put alumni wisdom to use in guiding undergraduates' academic choices, and how to internationalize the student body and the curriculum, with particular emphasis on the full integration of foreign students.

Recognition

The Harvard Assessment Seminars have been featured in The New York Times as well as a number of academic publications such as the AAHE Bulletin. Over 3,000 copies of the 1990 Report, written by the leader of the Seminars, Richard J. Light, have been distributed. The second Report, published in 1992, has also had wide circulation.

Available Information

The Harvard Assessment Seminars' Reports are available from:

Richard J. Light
Harvard Graduate School of Education
Larsen Hall
Cambridge, Massachusetts 02138
617-495-1183

HARVARD MEDICAL SCHOOL

A Randomized Controlled Trial Evaluating the Impact of the New Pathway Curriculum

Purpose

Despite many calls over the last fifty years for reform of the unintegrated, lecture-dominated curricula characteristic of American medical schools, few schools have embarked on change. Researchers in the Office of Educational Development at Harvard Medical School believed that the reluctance to reform the curriculum was in part attributable to the absence of any assessment of non-traditional forms of medical education that included a true control group. The purpose of this project was to carry out just such an assessment.

Project Activities

In 1985, Harvard initiated the New Pathway curriculum. This curriculum emphasized active, problem-based, student-directed learning in small groups. The program's learner-centered instructional strategies stood in contrast to the passive, large-group lecture method in use at most medical schools. In the New Pathway, basic science and clinical medicine were integrated throughout the four years, with students interacting with patients from the first week, and returning to basic science even in the fourth year. Each New Pathway participant developed a multi-year relationship with a generalist preceptor. The program was based on the notion that learning is facilitated when knowledge, attitudes and skills are taught together in relation to real clinical problems.

Students in the New Pathway Program were randomly selected from a list of volunteers. Those not chosen went through the traditional program with the non-volunteers. Thus three groups were available for comparison: those selected for the New Pathway Program, those who volunteered for the program and were not selected, and those who opted for the traditional program.

The project involved a comparison in six major areas between the volunteers who were selected for the New Pathway Program and those who volunteered but were not selected. The six areas were: 1) entry characteristics and study participation; 2) the cognitive domain: factual knowledge and learning behaviors; 3) clinical skills, including reasoning and problem solving; 4) psychosocial orientation; 5) students' personal experience of the old and new curricula; and 6) career choice. Students entering in 1985 and 1986 were followed for four years to assess both their responses to their educational experiences and the differences in outcomes for the two groups that might be associated with the differences in the design of their education.

Innovative Features

The students who volunteered for the New Pathway Program but were not selected provided a true control group. The two groups were of equal size and well matched on a wide range of factors including demographic characteristics, college grade-point average, research experience, Medical College Admission Test scores and several psychosocial characteristics.

More importantly, the control group could be presumed to have applied to medical school with the same orientation toward medical education as the experimental group: they had, after all, volunteered for the new program and had been assigned to the traditional one as

the result of a random selection process. Interestingly, though, by the time they arrived on campus the non-selected volunteers (control groups) showed a lower level of preference for discovery-style learning and a more positive orientation toward teacher-directed learning. This statistically significant difference may have resulted from chance or could have reflected an early adaptation to the methods and expectations of the curriculum to which these students had been assigned.

The researchers used a wide variety of bases for comparison of the two groups (34 in all) including demographic data, standardized test data, psychological measurement instruments, standardized patient assessments, cognition and reasoning tests, student statements, interviews with students and student participation in various sorts of learning activities. They were thorough and got surprisingly good cooperation from their subjects.

Evaluation

Though no formal evaluation of the assessment activity which constituted the project itself was undertaken, the project's completeness, care of design, and careful interpretation of findings give it substantial surface credibility.

Project Impact

The project's confirmation that the New Pathway Program was producing medical school graduates with levels of knowledge and clinical skills comparable to those in a traditional program at this highly selective medical school is an important finding. Such a conclusion can serve to reassure skeptical faculty that, at least in the case of the very brightest, a curriculum that is more student-centered,

fosters more active learning, provides better integration of basic science with clinical practice and places more emphasis on the social and psychological aspects of medical practice produces at least as high a degree of technical competence as the more traditional program. The demonstration that students develop significantly higher levels of humanism, as measured by a broad array of assessments at the end of year two, should affirm that enhancement of psychosocial competence can be achieved without measurable loss of technical biomedical competencies. These findings should help answer the question "Can we teach humanism?" with a strong "yes," in years one and two.

If the program's other outcomes (see below) are seen as advantages, this research can reinforce the efforts of medical curriculum reformers. It is too soon to know whether this work will contribute to such an agenda or not. One indication may be that, at least at Harvard, the entire curriculum has shifted to a more student-directed, problem-based format since the program has been in effect. Faculty who have had experience with the program tend to adopt its strategies.

Unanticipated Problems

While students participated at high levels during their first two years, data from the last two were more sparse. Students did not complete some of the instruments that required time and thought, or participate in certain exercises, such as standardized patient interaction or clinical problem-solving. Participation of larger numbers might have demonstrated more marked differences between the two groups, providing stronger affirmation of tendencies that are based more on convergence of findings than on sharp differences in data.

Major Insights and Lessons Learned

In addition to demonstrating an equivalence in knowledge and clinical competence between students in the traditional and non-traditional programs, the program evaluation revealed that students in the non-traditional program learned and employed more psychosocial skills, including more advanced skills in relating to patients during the first two years of study, and had more positive attitudes about the psychosocial aspects of their relationships with patients. Whether these effects persist to the end of the clinical study years could not be established due to the reduced size of the sample. New Pathway students preferred the student-directed learning environment and developed an ability to study for understanding rather than engaging primarily in rote memorization. The comparative lack of structure in the new program was more stressful, but students were more challenged and less bored by it. They also knew and were better known by their faculty during the preclinical years.

Recognition

The New Pathway Curriculum was the subject of a NOVA program on the Public Broadcasting System. Since completion of the project, faculty who participated in this study of the New Pathway received a grant from the Robert Wood Johnson Foundation to evaluate their new national initiative "Preparing Physicians for the Future."

Project Continuation

The Office of Educational Development at Harvard Medical School has developed an internal program evaluation that is supported by its operating funds and additional extramural support.

Available Information

Two research reports, several smaller papers, the FIPSE final report, and course materials are available from:

Gordon T. Moore
Office for Educational Development
Medical Education Center
Harvard Medical School
260 Longwood Avenue
Boston, MA 02115
617-421-2747

MIAMI UNIVERSITY

Assessing Models of Liberal Education: An Empirical Comparison

Purpose

Postsecondary institutions today are well aware of the importance of curricular assessment. When, as in the case of Miami University of Ohio, two alternative approaches to general education coexist on the same campus, the task of evaluating the outcomes of the two curricula becomes even more pressing.

Miami University wanted to distinguish the effects on student intellectual and personal development of two general education curricula: the University Requirement, a disciplinary, distribution-based general education program (replaced in fall 1992 with a new liberal education program), and the Western College Program, an interdisciplinary core curriculum.

Innovative Features

Miami administered a dozen different tests to matched groups of first, second and fourth year students enrolled in the disciplinary and the interdisciplinary curricula. Qualitative and quantitative measures were used, and cross-sectional as well as longitudinal data were collected and analyzed. As a result of this many-sided approach, a complex picture of the students emerged, along with certain patterns of strengths and weaknesses.

Evaluation

In general, measures of general liberal arts skills--the ACT-Comp (ARC version), the Academic Profile, the Test of Thematic Analysis, the Analysis of Argument, the Measure of Epistemological Reflection and the SUNY-Fredonia Tests of General Education--showed few significant differences between students engaged in the interdisciplinary curriculum and those in the disciplinary curriculum.

While performance on most measures was quite high, the results did suggest a need for students in both groups to increase their understanding of the scientific method and improve their knowledge of global issues. It also became apparent, from the Measure of Epistemological Reflection, that interdisciplinary students enter and graduate at a higher cognitive level than their disciplinary peers. The test's author speculated that Miami faculty in both programs may orient their teaching to a higher cognitive level than most students have achieved.

Several of the instruments used seem to have been designed for students of lower academic ability than Miami's, with the consequence that first year students received extremely high scores, leaving little room for sophomores and seniors to show gains. Several faculty members argue that many of the instruments used measure only traditional linear reasoning, and that in some cases higher-level reasoning processes exhibited by advanced students may have been evaluated negatively.

The most significant differences between the two groups of students emerged from tests of cognitive development and of specific academic behaviors and values--the Myers-Briggs Type Indicator, the ACT Activity Inventory, the College and University Environment

Scales, the College Characteristics Index, the College Student Experiences Questionnaire, and the Cooperative Institutional Research Profile. Data show that whereas students in the disciplinary curriculum exhibit higher levels of involvement in social and athletic activities, Western College students participate more frequently in the intellectual, artistic, political and human service activities of the campus. Although this category of instruments did reveal significant differences between the two groups, many of these differences were foreshadowed by entry data from the Cooperative Institutional Research Profile (CIRP) before the students enrolled.

Project Impact

As a result of the project, awareness of the importance of assessment and of the national attention and financial rewards that assessment programs can bring to institutions grew considerably on campus. New faculty were hired to strengthen instruction in scientific and quantitative reasoning. "Expectation Statements," written each semester by the interdisciplinary students only, yielded much information on how students experience their lives on campus, and led to some changes in the treatment of the sophomore year, particularly the development of the students' upper-level program of study. Further, because the tests were shown to have serious shortcomings for Miami students, faculty were stimulated to continue seeking better ways to measure the effects of general education (see below).

Unanticipated Problems

Because of the intensive and prolonged nature of the testing, it was difficult to ensure that students continued to participate. Thus, because of considerable attrition, the groups that began as highly

matched ended with a much lesser degree of matching. The task of transcribing the interview tapes also turned out to be inordinately laborious, and delayed the availability of an important source of data.

Major Insights and Lessons Learned

Although the project did not demonstrate consistent, significant academic differences between the two groups of students, clear differences did emerge in the areas of campus values, academic behaviors, involvement in learning and interpersonal interactions. It is not possible to tell, however, whether these differences result from the respective curricula, or from self-selection on the part of the students. A "chicken or the egg" conclusion was reached to the effect that campus cultures either shape the academic experience of students or are shaped by them.

Perhaps the most significant insight of the project for Miami University was related to the inadequacy of nationally available standardized liberal arts skills tests for measuring the different effects on student learning of the disciplinary and interdisciplinary curricula. This may be due to the high caliber of the populations being measured, which makes it very difficult to obtain gain scores large enough to differentiate between the two groups. On the other hand, the tests may not be sufficiently refined to measure the relatively subtle differences between the outcomes of the two curricula. It is possible that the curricula result in differences not in liberal arts skills, but in the behaviors and values mentioned above. It is also possible that the specific nature of the curriculum has less influence on

student learning than do campus ethos, student self-selection, class size, and other non-curricular factors.

The national standardized tests do, of course, provide national norms for student performance. Because they show a high degree of correlation with college-entrance scores, they may constitute more meaningful measures of recruitment efforts than of curricular effects.

Project Continuation

Two parallel portfolio programs implemented in fall 1992 assess both the Western College Program and the new liberal education curriculum. All students in the Western Program are required to keep portfolios. A random sample of 40 students campus-wide has been recruited out of each entering class since the summer of 1990 to participate in the project. Results have been shared via the liberal education newsletter, "The Miami Plan." A campus-wide Assessment Council developed a Statement of Philosophy and Goals for Assessment at Miami University, and the University Senate passed it unanimously in 1992. Implementation of assessment within the academic departments was the focus of the Assessment Council's work during the 1992-93 academic year, supported by a State of Ohio Program Excellence Grant and the Miami Liberal Education Program.

Available Information

In addition to its 1990 final report to FIPSE, the project has resulted in over 20 conference and workshop presentations. Several reports of project results, plus materials on the continuation of the project since FIPSE funding expired, are available: 1) Excerpts from the liberal education newsletter, "The Miami Plan," on portfolios,

student time use, interviews, and free-writing exercises; 2) the Miami Statement on Philosophy and Goals for Assessment; 3) the 1992 Summer Orientation talk to parents sharing assessment results; and, 4) the October 1992 AAHE Bulletin article, "AAHE's Assessment Forum Changes Hands," pp. 10-14, that provides observations about the Miami project and subsequent work. A chapter written with SUNY-Fredonia on the two FIPSE projects will appear in the Jossey-Bass book, Are We Making a Difference? edited by Trudy Banta.

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THE STATE UNIVERSITY OF NEW YORK COLLEGE AT FREDONIA

Improving Undergraduate Education: The Development of College-Wide Measures of Progress Toward Goals of General Education

Purpose

While curricular innovation is most frequently beneficial, if only because of the discussion and reflection it generates among faculty, rigorous assessment is essential in order to ascertain whether the new course of study has brought about the intended improvements in student learning. When SUNY College at Fredonia instituted a skills-oriented general education program (the General College Program, or GCP) in the early 1980s, the College made a commitment to assess the curriculum once it had become well established. The project was designed to investigate whether students were learning what faculty thought they were teaching, and whether the learning that was occurring resulted from the instruction the students received.

Since the GCP does not require all students to take the same courses, ways had to be found to measure skill acquisition that would not depend on academic content. Moreover, Fredonia faculty and administrators were determined to ascertain whether gains in student growth could be attributed specifically to their teaching rather than to the normal process of maturation. Before work could begin on any of these issues, however, faculty had to define the skills and understandings that students were expected to develop in sufficient detail to allow measurement.

Innovative Features

Persuaded that the assessment of liberal education should be an exercise in it, the proposal to FIPSE granted the twelve faculty members of the Assessment Committee ample time to engage in extensive study and reflection on the topic of assessment. At the outset, none of the committee members was an expert in the field. Nevertheless, as liberally-educated individuals and the ultimate experts on their own campus and students, they confidently embarked on the exploration of assessment. As a result, the project generated a sense of intellectual discovery--and therefore commitment--among faculty that would have been impossible without the opportunity to undertake intensive study and discussion.

The group's first decision was to reject standardized tests. Designed for students from infinitely varied backgrounds and diverse types of institutions, the instruments did not adequately match Fredonia's curriculum, and faculty believed that the objective format would test recognition rather than original thought or the ability to manipulate ideas.

The Committee members concluded that they would develop their own short-essay tests of the skills addressed by the curriculum: reading, writing, reflexive thinking, scientific reasoning, mathematical problem-solving, and socioethical understanding (critical thinking was subsumed in the preceding categories). The tests would be administered to freshmen and upper classmen as well as to a comparison sample composed of freshmen and upperclassmen at Miami University and Miami's Western College, selected because their high school achievement levels were thought to be similar to those of Fredonia students, and because at that time Miami University did not

have a skills-oriented general education program, but rather simply a distribution requirement.

Knowing students' proclivity to provide the answers they believe to be expected of them, Fredonia's Assessment Committee strove to elicit genuine responses rather than professions of faith. Thus the tests used open-ended questions and posed dramatic situations (a European exchange student criticizing certain aspects of American life, for example) to which students responded spontaneously and often passionately. The blind scoring system also examined essays for qualities not explicitly mentioned in the questions--such as ethnocentrism, or an exclusive focus on the present.

Recognition

The careful and unusual design of Fredonia's assessment project quickly attracted notice. Within the SUNY system, Fredonia has become a leader in assessment, participating in four regional SUNY assessment workshops. Members of Fredonia's Assessment Committee are in frequent demand as consultants; one faculty member served in the Exxon-funded 1989-90 portfolio project, described in the American Association of Higher Education's Time Will Tell: Portfolio-Assisted Assessment of General Education. The College maintains a mailing list of requests for information about the project, has made presentations at three AAHE assessment conferences and at regional conferences, and has conducted workshops for the South Carolina and Washington State assessment networks. A description of the project appeared in Assessment Update. Professor Karl Schilling of Miami University, currently director of the AAHE Assessment Forum, who collaborated with Fredonia and directed his own FIPSE assessment grant (see page 31), has integrated information about the Fredonia project in his own presentations and consulting.

Project Impact

The Assessment Committee produced nine tests, with scoring manuals, of reading, writing, reflexive thinking, scientific reasoning, mathematical problem-solving and socioethical understanding. These are instruments in which the faculty has confidence, that are sufficiently precise to allow for focused planning, and that can be used in the future to yield a longitudinal perspective on student progress. In the process of designing and administering these tests, faculty reflected on the purposes of the curriculum, learned about results of their program, and drafted recommendations for its improvement.

The findings indicate that Fredonia students make least progress in critical thinking--particularly with respect to discerning their own or others' assumptions and biases--and in problem-solving. Students showed little awareness of themselves as learners, and exhibited poor scientific reasoning. They also remained quite ethnocentric in their views, and failed to establish connections among different courses as well as disciplines.

Although the Miami University and Western College populations turned out to be less comparable to Fredonia students than had initially been hoped, the results of comparisons between the two groups showed a consistent pattern. In general Miami freshmen scored at the level of Fredonia upperclassmen. However, there was a greater difference between the scores of Fredonia freshmen and upperclassmen than between beginning and advanced groups at Miami University.

This was cautiously interpreted at Fredonia as meaning that the curriculum, and the way it is taught, is responsible for the gains made by Fredonia students. This finding is all the more positive in light of

research that indicates that better prepared students (in this case, Miami University freshmen) grow faster academically than their less-prepared peers.

Rather than suggest specific means of improvement, the recommendations on strengthening general education outlined by the Assessment Committee point to areas in need of attention. Two faculty study groups were formed to respond to these recommendations (see below).

Major Insights and Lessons Learned

The decision to dispense with outside experts and standardized tests not only produced custom-made instruments eminently suited to the campus and the curriculum, but resulted in a high sense of ownership of the project on the part of the faculty. This was enhanced by the visible commitment to assessment by administrators at the highest levels, and by the choice of highly respected faculty to serve on the Assessment Committee.

The project also yielded much incidental information on student learning, which, while often puzzling, nevertheless gave faculty a deeper insight into teaching and learning at Fredonia. Finally, the task of assessment itself was instructive, forcing faculty to give shape to their ideas of what constitutes effective teaching, and giving students the opportunity to reflect and write on a number of issues, and thereby increase their awareness of themselves as intellectual beings.

Participants in the project, having found standardized tests insufficient to their needs, welcome the national trend towards embedded assessment. Before this can succeed on a large scale,

however, scoring techniques for long-term qualitative measures of portfolios, essays, and recorded interviews must be developed. The project findings, and more than likely the collaboration with Miami University as well, have caused project participants to reflect on the need to develop ways of measuring the correlation between academic and extra-curricular involvement.

Unanticipated Problems

It was learned belatedly that, while both Fredonia and Miami University freshmen had high school averages of B+, the numerical equivalent of that grade was 86 in New York and 91 in Ohio. Thus, the Miami University students were better prepared academically than their Fredonia peers, and this affected the assessment process.

In addition, although the purpose of the project was to find out the effects of the GCP specifically, it became impossible to distinguish whether the gains made by upperclassmen were due to the GCP courses alone or to other courses in the curriculum, especially since the College's entire program aims to develop the skills being measured.

Project Continuation

Two faculty study groups were formed to address the findings of limited student improvement in identifying biases and assumptions in reading and in their own thinking, and insufficient improvement in problem solving. As a result, workshops on problem solving have been instituted for faculty teaching introductory courses in mathematics.

Some changes have been made in the GCP itself. The departments of Chemistry, English, Foreign Languages, History, and Political

Science experimented with portfolios as a way to help students improve reflexive thinking and make connections among courses. English and Foreign Languages have since made portfolios a permanent part of their programs. In general, the revised GCP emphasizes the attributes of thinking evaluated by the project, and increases the amount of attention to cross-cultural or international matters required in all fields.

To assess the effect of these changes, the College is repeating its study. All nine tests were given to incoming freshmen in summer of 1991, and will be repeated with a sample of these same students in spring of 1994.

Available Information

A substantial final report was filed with FIPSE at the end of the project. Two campus reports have been produced. The GCP and Student Learning: A Report To The Campus, appeared at the conclusion of the grant. The second, entitled GCP Study Group Reports, presents the conclusions of two faculty groups that met to examine the findings and recommendations of the Assessment Committee in the areas of critical thinking and problem-solving. For information about these reports, contact:

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THE STATE UNIVERSITY OF NEW YORK COLLEGE AT PLATTSBURGH

Comprehensive Assessment in Academic Disciplines

Purpose

Assessment within academic disciplines must meet two seemingly contradictory criteria: on the one hand, it must reflect the particular perspectives of the departments involved; on the other, it must yield comparable data on student performance.

To reconcile these divergent requirements, the State University of New York College at Plattsburgh organized an assessment consortium composed of five SUNY colleges: Buffalo, Cortland, Fredonia, Plattsburgh, and Potsdam. The colleges sent teams of two faculty from several, but not necessarily all, of the following disciplines: Biology, Teacher Education, Foreign Language and Literature, History, and Psychology.

Innovative Features

The purpose of the consortium was to develop comprehensive examinations in each of the five disciplines. To achieve this purpose, teams met over a period of three years and engaged in a step-by-step process that yielded considerably more than a set of assessment instruments.

The teams began by defining the nature of their disciplines with respect to undergraduate learning, discussing not only content but the field's epistemology as well as its contributions to society, its purpose, values, and ethical standards. Faculty next examined the assessment

strategies most appropriate to each discipline, frequently discarding approaches grounded in traditional psychometric theory in favor of measures that seemed most accurately to reflect learning in each field. Most importantly, at the conclusion of the process they engaged in discussions of the implications of assessment for curricular reform.

The Biology group developed an assessment of the following goals: 1) to provide students with broad-based general knowledge and familiarize them with the language of science; 2) to provide students with some basic laboratory skills and training in the proper use of standard instrumentation; and 3) to increase student awareness of current issues in science, especially the relationships of science to society and the ethical questions inherent in the use of technology.

The Psychology group developed an objective multiple-choice test that meets rigorous standards of measurement. The instrument consists of three parts: 1) a content section that assesses knowledge of concepts, terms and principles in ten basic areas of Psychology; 2) a critical thinking or "process" section that assesses ability to analyze research; and 3) a section that assesses the relationship of course experiences to the scores on the first two sections.

The Teacher Education assessment model included a 40-cell matrix generated by four domains of assessment and ten program elements. The Education group sought assessment strategies and data sources to label judgments in each of the cells of their matrix. They explored potential contributions from sources such as vignettes, portfolios, observations, video tapes, questionnaires, interviews, written exams, jury by peers, etc.

The History group developed and refined an assessment instrument which allowed students to reflect in various ways on what they have learned during an undergraduate course in history. Students are assessed on their synthesizing/analytical capabilities as supported by comparative historical reasoning and evidence. An interpretive essay assignment allows students to synthesize diverse historical information as they attempt to validate or challenge provocative generalizations. Students are asked in addition to demonstrate their command of factual contextual historical knowledge. A battery of eight multiple-choice tests allows them to choose areas of competency which they are certain to have encountered. The final version of the assessment includes questions on the nature of the historical discipline and its practices.

The Foreign Language and Literature group focused its activities on six key areas embodied in all foreign language programs: oral proficiency, writing skills, listening comprehension, reading proficiency in the foreign language, "proficiency" in literature, and knowledge of civilization and culture. The group constructed grids for each of these six areas modeled on the ACTFL/ETS guidelines for proficiency. Oral skills are assessed in an interview format, and the writing and literary interpretive skills through written assignments. A multiple-choice format assesses basic knowledge.

Evaluation

The project was evaluated on the basis of three goals. The first was the creation and maintenance of an inter-institutional consortium within a large public university system. Achievement of this outcome was demonstrated by the actual sustained efforts of the consortium. Furthermore, participants engaged in an analysis that generated insights into the dynamics of operating such a consortium.

The second goal was the development of assessment-related conceptual frameworks for each discipline so that assessment strategies could be devised in accordance with a comprehensive understanding of the key elements and boundaries of each discipline. These frameworks were evaluated according to the nature of the discipline in question. In some cases, external reviewers were asked to comment on the quality of the work. In other cases, the participants made their own judgments based on comparisons with existing frameworks within their disciplines.

The third goal was the development of assessment strategies for each discipline. The effectiveness of these strategies and instruments was again evaluated in different ways for each of the participating disciplines, but each involved some form of field-testing to verify its utility and viability.

Project Impact

The project resulted in the creation and maintenance of a consortium of institutions within a state university system. Not only did it yield many insights into the operation of such a system, but the coming together of faculty from different disciplines and institutions for the sake of a common endeavor produced in the participants an unanticipated sense of renewal and stimulation. Each disciplinary team developed an assessment-related conceptual framework that not only produced an assessment instrument as a direct result of the team activities, but one which can be used in the future to develop other measures.

Major Insights and Lessons Learned

When faculty joined the consortium, they believed that they were about to engage in a team effort to construct comprehensive examinations based on the knowledge they already possessed of teaching and learning in their discipline. Instead, they found themselves participating in an arduous intellectual exercise of questioning and rethinking not only matters related to their discipline, but the nature of teaching itself. As a result, participants became passionately committed to the work of the teams, and faculty development turned out to be one of the project's primary benefits.

Those involved in organizing the consortium concluded that the following strategies are essential to the success of projects such as this one:

1) Faculty must be given as much autonomy and freedom from bureaucratic interference as possible.
2) Participants must be selected according to their commitment to the project; their knowledge of the discipline; and their ability to communicate, to work within a team, and to provide leadership in their own departments.
3) Faculty must be given control over the data that the project will yield. This allays fears that assessment results might be used to harm individuals or departments, and allows the work to proceed within the norms of scholarly inquiry.
4) A retreat-like setting stimulates informal discussion and interaction.
5) Occasional interdisciplinary meetings should be held, since contact among individuals from different disciplines fosters creativity.

6) An adequate stipend (in this case, roughly the equivalent of remuneration for one summer course) not only allows administrative control over minimum compliance but, most importantly, conveys a sense that the work is valued.
7) The performance of each team is largely dependent on its coordinator; therefore, these individuals need extensive training and support.
8) The leadership and commitment of central administration are essential to the success of projects such as this one.

Unanticipated Problems

As many who have engaged in assessment know, it is difficult to involve students in the process unless it is mandatory and minimum performance levels are specified. Unfortunately, not only does such an approach restrict the kinds and extent of skills and values examined, but it also may proscribe creative or experimental approaches.

The traditional, more limited assessment measures usually yield information that is only of marginal value for improving teaching and learning. Yet assessment instruments should not be used to judge students or curricula unless their validity and reliability have been amply demonstrated, something that is of course more difficult to establish with locally-developed measures. The project yielded no solution to this dilemma, although participants emerged with a conviction that assessment is of great value in teaching and learning.

When conducted in the ways outlined above, assessment is not only labor-intensive but expensive as well. Thus, despite its unquestionable success in fomenting discussion of profound academic issues, it is not certain that the activities of this project will continue.

Available Information

The project produced a number of papers and reports. Chief among these are the Final Project Report to FIPSE, as well as a report on each participating discipline. Furthermore, several papers based on the work of various groups have been presented at professional organization meetings by project participants. Information about these papers can be obtained by contacting the project director or the group coordinators listed below, all of whom are faculty at SUNY/Plattsburgh in the departments of the discipline they represented.
The specific reports are as follows:

Biology Group Report, prepared by Bonnie Seidel-Rogol
Foreign Language & Literature Report, prepared by Craig Sample
History Group Report, prepared by Douglas Skopp
Teacher Education Group Report, prepared by Nick Stupiansky
Psychology Group Report, prepared by Henry Morlock

Copies of all these reports can be obtained by contacting the Project Director:

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WINTHROP COLLEGE

South Carolina Higher Education Assessment (SCHEA) Network

Purpose

The South Carolina Higher Education Assessment (SCHEA) Network, a 47-member statewide consortium of South Carolina colleges and universities, was established in response to state and accreditor assessment mandates. Its primary purpose was to develop collaborative relationships among a group of colleges and universities largely unprepared for the challenges of assessment. Network organizers assumed that properly coordinated consortial arrangements and centrally provided technical assistance would enable members to initiate quality assessment programs faster and less expensively than they could achieve on their own.

Innovative Features

At the outset, there were few promising signs for an effective assessment consortium, given the limited resources committed in South Carolina to assessment, the fierce rivalries among sister institutions, and an unwelcoming attitude on the part of most higher education professionals towards state assessment mandates.

When Winthrop University emerged as leader of the consortium, some felt that it had few obvious qualifications to mount such an ambitious project. A relatively small institution, formerly a state women's college tucked up in a corner of the state, it had no distinctive mission or constituency. Yet several Winthrop administrators and certain members of Winthrop's Psychology Department

foresaw the need to coordinate assessment assistance to member institutions statewide. They formed the Network Coordinating Center at Winthrop to provide organizational, informational, and technical assistance and mutual support services, and to collect and produce assessment resource materials.

Evaluation

The primary learning targets and beneficiaries of the SCHEA Network were the faculty and administrators of member institutions. Yearly evaluations were conducted of the Network's objectives, assessment activities of members, staff performance, conferences, workshops, presentations, consumer demands inside and outside of the Network, dissemination, and changes in SCHEA member participation.

Five external evaluators, all prominent nationally in assessment, judged the SCHEA Network project and its activities very highly. They pointed to the consortium's statewide influence in assessment policy as evidenced by the Network's symbiotic relationship with the Commission on Higher Education, its effectiveness in promoting inter-campus collaboration, and its role as the assessment resource for 42 higher education institutions in South Carolina. They dubbed it "the best state assessment consortium in the country, and one that other states should emulate."

A three-year evaluation data summary based on ratings from Network members and program records showed marked increases in Network membership and inter-campus collaborations; increased conference attendance; favorable attendee evaluation; consistently positive Advisory Board assessments of SCHEA, its activities,

objectives, services and staff; and skyrocketing gains over the three years in requests to the Network for technical assistance, bibliographies, and publications.

Project Impact

Originally, the project aimed to attract a core group of consortial participants from at least 12 institutions, who would generate momentum for participation across the whole state. In fact, in the three-year grant period, the SCHEA Network pulled together 42 institutions, including all 33 public colleges and universities in the state, seven private institutions, and two state agencies. Beyond this organizational framework, Winthrop developed an exportable and practical primer, A Beginner's Guide to Higher Education Assessment, to help orient newcomers to the major issues, models, options, and obstacles to assessment.

Today, hundreds of requests for assistance and materials from all 50 states and six foreign countries far exceed the Network's ability to respond. Requests for on-campus workshops and needs assessments are especially difficult to answer. Network staff have annotated and printed over 700 assessment references, 120 instruments and methods, and eight assessment newsletters (The eXchange). These materials constitute a lending library of assessment resource materials for SCHEA members. Winthrop's full-day Beginner's Guide Workshop has become a staple of AAHE's National Assessment Conference.

Major Insights and Lessons Learned

Virtually every program associated with the SCHEA Network has reported positive impact on program quality. Admittedly, these programs refer to clear and substantial process benefits of assessment rather than student outcome data that may be forthcoming later.

With a consortium, time and cost estimates seem to expand exponentially and are extremely hard to manage. The Network found that the nature of assessment made everything take longer than planned, whether it was designing, piloting, implementing, analyzing, evaluating or disseminating.

Network staff found that most higher educators stand to benefit from undertaking assessment, whether they know it or not. Once misperceptions and myths about assessment were removed, SCHEA participants became more supportive and willing to put in long hours, believing that their effort would one day benefit their students. Even long-standing patterns of rivalry and mistrust among SCHEA institutions did not stand in the way of productive collaboration. The key strategy was to lure central campus leaders with the repeated theme that assessment would enhance the quality of programs.

However, even the best programs can expect a hard core minority to oppose assessment, whether out of suspicion, fear, or bias. Winthrop's lesson from its own experience is similar to that of others, i.e., opposition is to be expected with any major reform, and it should not dissuade or impede assessment efforts. The Network credited the generous help of other FIPSE project directors in assessment who provided useful and innovative ideas that improved the efficiency and quality of the Network.

Project staff recommended that FIPSE fund: (1) more evaluations of assessment methods, especially of their validity; (2) more assessment consortia; and (3) more projects that consolidate and analyze the conflicts and redundancies among rapidly proliferating assessment-related laws, regulations, and guidelines.

Project Continuation

SCHEA Network activities have received sufficient support from the Commission on Higher Education, Winthrop University and membership fees to continue, despite the worst fiscal crisis in the state's history. Substantial interest in adopting the Network's South Carolina consortial model in North Carolina, under the sponsorship of the North Carolina Association of Colleges and Universities, has taken the form of exchanges of information, planning meetings and on-campus visits.

During the project's second and third years, academic area networks of multi-campus interest groups were formed, to share assessment experiences and innovative strategies, and to plan collaborative activities. Begun with fewer than a dozen members in 1990, there are now 14 mini-networks with over 200 members, one of the most promising legacies of the SCHEA Network.

Additionally, SCHEA has begun establishing liaisons with assessment mandators and other groups influential in assessment policy and implementation. Through these liaisons SCHEA hopes to perform a beneficial consultative and advisory role. Last year a joint South Carolina Commission on Higher Education Staff/SCHEA Task Force developed recommendations for ways to implement the federal "Student Right to Know" and state "Higher Education Accountability"

acts in South Carolina. These recommendations have been adopted. In spring, 1992 SCHEA established an information-sharing relationship with the staff of the state and national Educational Goals Panels, and several SCHEA members have been nominated to serve on advisory councils to those groups. SCHEA nominations have been solicited by the Southern Association of Colleges and Schools regional accrediting agency to help strengthen their institutional effectiveness and assessment evaluator pool. In addition, SCHEA became a formal affiliate of South Carolina's most influential non-governmental higher education group, the South Carolina Council of Presidents.

Since the SCHEA Network primarily represents the "troops in the trenches" in higher education assessment, these new liaisons may well afford earlier, more effective practitioner input to policy development, which will in turn encourage higher quality assessment programs throughout the state.

Available Information

The SCHEA Network has produced over 30 reports and other resource materials, including organizational documents (e.g., membership lists, committee charges, conference programs, and evaluation forms), project reports, and assessment-related publications. The Network will share these materials on a copy cost or maintenance fee basis.

The following are available:

- SCHEA Network Publications List
- A Beginner's Guide to Higher Education Assessment (Available in a workshop version and a condensed version.)
- The SCHEA Annotated Bibliography of Higher Education Assessment Literature
- The SCHEA Annotated Bibliography of Student Personnel Development Assessment
- A Selected Bibliography of Learning Research Literature
- A Critical Review of Student Assessment Options
- The SCHEA eXchange Newsletter, Issues 1-8
- The SCHEA Network Lending Library of Assessment Resource Materials
- Assessing Assessment: An In-Depth Study of the Higher Education Assessment Movement in 1990 (ACE-supported)
- Sample Assessment Plans for Students' Personal Development
- Final Report to FIPSE for the SCHEA Project

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COLLEGE AND UNIVERSITY TEACHING

Assisting students who are having difficulty with basic courses has absorbed enormous amounts of institutional energy and proven a source of great frustration to faculty and administrators. At the University of California at Berkeley, the work of Uri Treisman has proven so successful in improving the mathematics performance of underprepared African-American students that it has been widely copied in a variety of circumstances and subject matters elsewhere. The "Medical Scholars Program" at the University of California at San Francisco exemplifies the adaptability, in this case to medical education, of Treisman's "Professional Development Program." At Salem State College, adaptation of a similar model, Supplemental Instruction, has improved student performance in a variety of arts and sciences subjects.

These three programs make heavy use of collaborative learning and problem solving, and use advanced students as group facilitators. Their effectiveness is readily demonstrable.

Of a different order of concern but no less vexing to those directly involved in teaching and learning are the problems of novice library users in gaining access to multiple sources of bibliographic assistance. The Ohio State University libraries have successfully addressed this problem by combining multiple sources of information into a single computer program employing simple commands and uniform screen formats.

UNIVERSITY OF CALIFORNIA-BERKELEY

The Professional Development Program

Purpose

In the late 1970's, Uri Treisman and colleagues at the University of California at Berkeley began a study to understand the dynamics of minority student performance in freshman calculus. A systematic review of Berkeley transcripts showed the magnitude of the problem: in a decade there was not a single year in which more than two ethnic minority students received grades of B- or better in first-term calculus. In his FIPSE proposal to remedy this situation, Treisman observed that freshman mathematics and science courses have all too often been burial grounds for the aspirations of minority students who enter college with the goal of majoring in engineering, or one of the sciences.

An eighteen-month ethnographic study helped Treisman understand the various obstacles to minority student success at Berkeley. In particular, he found that the widely held conventional explanations for failure--lack of student motivation, lack of academic preparation, lack of family support, and low average socio-economic status--did not, in fact, explain the phenomena he observed. He found, instead, a pattern of social and intellectual isolation which eventually led to students' demoralization, disorientation, and ultimately, their decision to leave the sciences. Many of these students, moreover, dropped out of the University.

Many of the African-American students Treisman observed studied alone, and maintained a rigid separation of their academic and social lives. This pattern was in marked contrast to that of Chinese students

in Treisman's study, who typically created an academically-focused social group that served to support their aspirations for high achievement. In their informal groups, Chinese students discussed their academic work as well as such topics as interacting with faculty, the intricacies of getting a needed answer from an administrative office, financial aid, and so on. Treisman believed that by creating a rich mathematical environment in which such collaboration among students was natural, African-American and Hispanic students would be drawn to mathematics and would thrive.

Treisman also observed the subtle and insidious ways in which special campus orientations and programs for minorities tended to marginalize the populations they served. In particular, he noted that for many minority students at Berkeley the locus of their campus identity was ethnicity rather than intellectual interests or professional goals. He came to believe that the resulting ethnic balkanization of the Berkeley student body impeded minority students' progress in mathematics-intensive majors. Thus, to address the underrepresentation of minorities in mathematics, it would be necessary to create viable and robust multiethnic student communities drawn together by a shared interest in and affection for mathematics.

Innovative Features

In 1980, with support from FIPSE, Treisman established the Mathematics Workshop Program as a component of the Professional Development Program (PDP), an affirmative action effort of the University of California Academic Senate, Berkeley Division. The immediate and most visible goal of the project was the development of a cadre of minority students who would truly excel in calculus. The Workshop Program explicitly rejected remedial approaches to minority education.

Workshops of 20 to 25 participants worked together in small groups on problem sets specifically designed to deepen their understanding of concepts needed not only for their present course, but for later mathematics and science courses. These sessions were overseen by graduate instructors who did not lecture or repeat class material, but turned questions back on the group to help students understand the material for themselves. This approach was a substantial departure from the individualized tutoring, self-paced instruction, mentoring, and study skills courses which constituted the pedagogical armamentarium of institutionalized minority programs.

Evaluation of the Original Development of PDP

According to the evaluation of the first seven years of PDP, students did indeed excel. The results are unparalleled: 56% of the African-American workshop students earned a grade of B- or better in first-year calculus, compared to 21% of the non-workshop African-American students. Beyond this, significantly fewer workshop students dropped out of calculus than non-workshop students (3% versus 25%) and four times more of these students graduated in math-based majors (44% versus 10%). These results persisted even when differences in pre-college preparation for mathematics were taken into account.

African-American students who attended the workshops and whose MSAT scores suggested they were at the greatest risk of failure outperformed the non-workshop African-American students at lowest risk of failure. In other words, weakly prepared students gained as much or more than students entering Berkeley with strong academic backgrounds. Further, African-American workshop students persisted to graduation at rates comparable to those of the campus as a whole,

while African-American non-workshop students dropped out at substantially higher rates.

Project Impact

The Mathematics Workshop had a dramatic effect both on mathematics performance and on the persistence rates of participating students at Berkeley. Based on these successes, FIPSE again funded PDP in 1986 to assist 20 other campuses across the country to set up local adaptations of the project. PDP staff worked with faculty and administrators from colleges and universities to customize the project appropriately for each new setting. Many of the original twenty dissemination sites succeeded in creating effective programs: an evaluation of student performance at several of them showed the following results:

- At the University of Texas-Austin, where the program is known as the Emerging Scholars Program (ESP), the workshops are regular departmental offerings--effectively an alternative to traditional discussion sections. There are presently five ESP sections serving approximately 100 students per semester, three-quarters of whom are African-American or Hispanic. The program also targets white stu-dents from rural Texas. Results of the program have been dramatic. Over 85% of all ESP students routinely earn grades of "A" or "B" in calculus. (To place this in an historic context, fewer than one-third of non-ESP African-American and Hispanic students who took calculus in the last five years received grades of "A" or "B." Only half of those students with Math SATs over 600 received such grades; in contrast, 90% of the minority ESP students with such scores have earned grades of "A" or "B."). In 1988, there were fewer

than 10 minority math majors at UT Austin. In Spring 1992, there were 113 minority mathematics majors, many of whom were ESP alumni.

o At Rutgers, the State University of New Jersey, students enroll in a six-credit-hour calculus class called EXCEL; the usual calculus course is four credit-hours. One section of EXCEL is housed in the College of Engineering, and another is housed at Douglass College for Women. Thus far, 75% of EXCEL calculus students have earned a grade of "A" or "B" as opposed to 41% of all students in the regular calculus classes.

o City College of New York (CCNY) is an urban commuter college; two-thirds of the entire student population is African-American or Hispanic. Students in the CCNY workshop program participate in six hours of intensive mathematics laboratories as a supplement to their basic calculus class; four hours of this lab time is overseen by advanced undergraduate students. 88% of participating students have received grades of "B" or better in calculus.

o At the California Polytechnic State University at San Luis Obispo, the Emerging Scholars Program (ESP) offers workshop laboratory sections in precalculus and calculus. These labs are attached to particular lectures and are led by advanced undergraduates who have expressed an interest in teaching. Consistently over the four years of the program, 90% of the students have achieved grades of "C" or better in calculus; typically, two-thirds of non-ESP students make such grades. In 1988, the year of the pilot, 85% of ESP students earned grades of "A" or "B," while only 18% of students not participating in ESP labs earned similar grades.

o The California State Polytechnic University at Pomona runs a workshop program for minority students enrolled in the College of Engineering and the College of Science. The program serves more than 100 minority freshmen a year. A recent retrospective longitudinal study (conducted by Marty Bonsangue and supported by the National Science Foundation) of minority workshop participants from 1986 to 1991 found that workshop students scored, on average, six-tenths of a grade point above their classmates in calculus. Bonsangue found that participation in the workshops had a powerful effect on students' performance and persistence in subsequent mathematics and science coursework, as well as on graduation in a technical major.

o The Medical Scholars Program (MSP), an adaptation of the workshop, was established with FIPSE support at the University of California at San Francisco School of Medicine (described on page 77). Minority student failures in physiology and other first year courses declined significantly; the school's overall pass rate on the National Boards improved; and pre-medical school achievement ceased to be a significant predictor of minority and non-minority students' scores.

Evaluation of the PDP Dissemination

An extensive summative evaluation was conducted of each of the campus pilot programs and student performance, using appropriate comparison groups. Specifically, it examined the relationship between background characteristics (e.g., race, sex, SAT scores, high school rank in class, etc.) and achievement in math and science. A qualitative observer's report was also completed to provide faculty at other sites with a description of key features of the program, how it operates

internally, how it may be adapted, and how it appears to its participants.

Project Continuation

There are currently over 100 mathematics departments offering students a "Workshop/Emerging Scholars" program. In 1991, Treisman received a grant from the National Science Foundation (NSF) to create the Alliance for Minority Participation in Mathematics (AMPM), which will expand to at least 200 the number of mathematics departments offering such programs.

The program has expanded both to the upper-division and pre-collegiate levels. The Summer Mathematics Institute (SMI), variously funded by the Sloan Foundation, the Dana Foundation, and the National Science Foundation, is an immersive six-week residential summer school, principally for ESP alumni, designed to enable them to make an informed choice about graduate work and careers in the mathematical sciences. In fall 1993, approximately 20 SMI alumni will begin work in mathematics at elite graduate programs.

At least ten mathematics departments have created versions of ESP for high school students and teachers. These initiatives, most often called "C-cubed" programs, have received generous support from the National Science Foundation and from local school districts.

Several successful sites have emerged as secondary dissemination sites, helping institutions in their region to learn from their work. Moreover, the process of dissemination has led to substantial improvements in the model, some of which have influenced the shape and direction of the original Berkeley program.

The Workshop Program itself has undergone many transformations. Most important is the shift from adjunct status, i.e., as a voluntary add-on program, to becoming an integral part of a math department's offerings. In some institutions, the Workshop Program has been a catalyst and model for the reorganization of departmental courses. Currently, there are many departments seeking to utilize the Workshop model as a vehicle for bringing about curricular change. The increased class time and the focus on student community make it a natural environment for curricular experimentation. Finally, the Workshop approach has become a highly visible example of faculty leadership in such problematical areas as multiculturalism, academic culture change (i.e., resetting the balance among research, teaching, and service), and quality management.

Recognition

PDP's project director, Uri Treisman, was honored with the Charles A. Dana Award for outstanding achievement in American higher education. The Dana Foundation then awarded Berkeley approximately $1 million for the creation of the Charles A. Dana Center for Mathematics and Science Education to continue to disseminate Workshop Programs. In 1989, Newsweek selected Treisman as one of 25 Americans on the leading edge of innovation, one of three in education. In 1992, he won the MacArthur Fellowship Award for his pioneering work in increasing minority participation in mathematics.

The California State Legislature awarded $500,000 to create PDP workshops on each of the nine campuses of the University of California. The National Science Foundation sponsored a Chautauqua short course for math and science faculty on increasing minority participation in math-based disciplines. A minority student and

alumna of PDP at Berkeley was named a Rhodes Scholar--the first woman, first African-American and first engineering student on campus so honored.

Available Information

A FIPSE-sponsored lecture that describes the project, Academic Perestroika: Teaching, Learning and the Faculty's Role in Turbulent Times, is available upon request from:

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UNIVERSITY OF CALIFORNIA AT SAN FRANCISCO
SCHOOL OF MEDICINE

The Medical Scholars Program

Purpose

Nationwide, minority students and women are underrepresented on the faculties of medicine and the basic sciences. An American Association of Medical Colleges study indicates that fewer than 2% of the nation's medical school faculty are from the underrepresented minorities. The UCSF Medical Scholars Program (MSP) was launched as a direct response to the need for minority academicians.

A secondary and more immediate aim was to reduce minority attrition and course failure of "at-risk" students. MSP is based on the Professional Development Program pioneered in mathematics at the University of California-Berkeley, using small study groups or workshops to promote achievement among minorities. Applying the PDP model, MSP used peer groups and preceptorships to improve learning in pre-clinical courses.

Even though MSP was initially labelled a minority program, it was designed to be open to all first-and second-year medical students, and non-minority students did fully participate. It made the uncommon assumption that students entering the program had the ability to excel, regardless of test scores, and its job was to aid in that achievement. MSP's intent was to be prospective and preventive rather than remedial.

Its student-led workshops met weekly for two hours to work on the key organizational and conceptual skills necessary to master vast amounts of medical information. To do this, student groups of 20 to 25 used a series of problem sets to quiz and test each other. These worksheet problems were constructed so that students had to forge solutions collaboratively and use a variety of skills to answer questions posed in physiology, anatomy, and biochemistry courses. Ultimately, the problems led students to examine the relationship between their courses and clinical material by applying basic concepts to abstract situations.

The workshops performed obvious social functions as well. The encouragement and support they provided eased the transition to medical school, helped students build friendships, and taught them survival skills.

In the second year, students participated in a special study group review to prepare them to pass the National Board of Medical Examiners Part 1 test, a certification examination taken after pre-clinical studies.

Beyond supporting coursework and preparing for the National Boards, the program oriented its students to research careers through a series of informal "science chats" with faculty and a quarter-long research elective. During summer internships, students participated in basic social science research in laboratory settings, in local communities (AIDS and sexuality), and overseas (diabetes in Italy, cardiovascular disease in Spain).

Evaluation

Historical information from medical school student records was used as a quasi-experimental control for the results observed during the operation of MSP. Data from MSP's three years (1987-89) were compared to data for the three years prior to MSP. The latter indicated that minority students enter UCSF with a slight academic disadvantage: between 1983 and 1986 minority students failed courses and the National Boards at rates out of proportion to their numbers in class and strongly correlated with their academic disadvantage. Failures among first-year minority students were most pronounced in physiology. In 1983, for example, African-American and Latino students constituted 18% of the enrollment in physiology but 54% of those who failed the course.

Significantly, in the program's three years, none of the minority students enrolled in MSP physiology workshops failed, and MSP students passed all of their first-year basic science courses. They achieved this even though their mean undergraduate GPA and their combined MCAT scores were significantly below those of non-MSP students.

Project Impact

In its first three years, MSP served 164 students, 93 white and 71 non-white. It can claim three strong outcomes: minority failures in pre-clinical courses declined; the school's pass rate as a whole improved on the National Boards; and pre-medical school achievement ceased to be a significant predictor of minority and non-minority students' exam scores.

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Over the years, the number of minority students participating in summer research doubled. One student published her findings in the New England Journal of Medicine and another won a year-long research fellowship at the National Institutes of Health.

Annual interviews with workshop students, leaders and faculty members suggested a school-wide effect of two kinds: MSP led minority students to believe that careers in academic medicine were possible for them, and it showed them the value of group study and of seeking academic help. Two unanticipated benefits were also noted: the workshops helped identify early those students having academic difficulty, and students gained valuable experience as workshop leaders and teachers.

Major Insights and Lessons Learned

Medical school in the United States is reputedly a stressful and demanding experience. As viewed by its students and faculty, MSP positively altered the environment of UCSF without compromising quality--in fact, student performance improved. This holds important lessons for changing the learning climate in other medical schools further. MSP validates the Professional Development Program at UC-Berkeley, which originated this approach to improving minority performance, by demonstrating that PDP can be translated from math to the medical school curriculum without losing its impact on learning.

Project Continuation

Institutional policies were adapted to support MSP as a student-directed initiative, now funded through the Dean's Office. That decision was made on the basis of the evaluation data collected for the

program, including feedback from student participants. Even after FIPSE funding ended, the numbers of students served by the program continued to increase every year, and now encompass over 70% of the first-year class.

A dissemination grant from FIPSE was used to prepare workbooks from the collection of learning-group worksheets. These workbooks were distributed free of charge to medical schools around the country.

In 1991, Columbia University College of Physicians and Surgeons (P&S) created the Higher Achievement Program (HAP), modeled on MSP and motivated, in part, by a marked increase in the number of minority students entering in the first-year class that fall. Past experience of minority students at P&S suggested that these new entrants would be at high risk of failure. For example, in 1988, three of twelve (25%) entering minority students had to repeat their first year coursework, and two of sixteen (13%) minority students entering in the 1990 academic year were forced to repeat. Faculty and students agreed that some intervention was needed to ensure the smooth transition of students from undergraduate to medical school study.

In its first year of operation, HAP offered workshops in anatomy, physiology, neurosciences, cell biology and physiology. In addition, special sessions were offered to prepare students for practical examinations in anatomy and cell biology. The program was remarkably effective: the number of students failing courses declined, even though the number of students at risk for failure had increased. None of the minority students entering in 1991 was asked to repeat the year. A full evaluation of the program will be conducted in the future, but faculty and students were encouraged by the results of HAP's first year.

Available Information

Copies of the final report submitted to FIPSE and of the MSP workbook used in the study groups may be obtained from:

Emilie Osborn
Associate Dean of Student and Curricular Affairs
University of California at San Francisco School of Medicine
Room S221
San Francisco, CA 94143
415-476-0714

or

Mindy Fullilove
Associate Professor of Clinical Psychiatry and Public Health
722 W. 168th Street, Box 29
New York, NY 10032
212-740-7292

THE OHIO STATE UNIVERSITY LIBRARIES

The Gateway To Information

Purpose

Librarians are universally familiar with the novice researcher who, having been set a writing task, proceeds directly to the card catalog, jots down the titles available on his topic, checks out the ones he can find on the shelf, and considers his bibliographic effort complete. Periodical indexes, abstracting services, biographies, almanacs, government documents, and technical reports might as well not exist: the library's arsenal of information mystifies and intimidates most students, and only the adventurous or the experienced ever benefit from it.

The Gateway to Information, a microcomputer program designed and developed in the course of this project, guides students to find, evaluate and select the materials that meet their research needs. It functions as a front-end to the online library catalog and CD-ROM databases, guiding users to create a search strategy that includes print and computerized information. It enables users to access and integrate the content of online catalogs and CD-ROM databases, and encourages them to seek varied sources of information and to evaluate the information they find.

Innovative Features

Most libraries use computer technology to inform the public about general library services or to conduct specialized searches of commercial databases or of CD-ROM-based indexes. The libraries that

teach all-encompassing search strategies do it with lectures and printed materials, and only a few offer an organized information-seeking approach that integrates different sources. The Gateway's uniqueness lies not only in its ability to accomplish the latter, but in that it guides the user to identify, locate, and evaluate the appropriate materials.

The Gateway provides access to 31 dictionaries; five general and 82 subject encyclopedias; 70 periodical indexes (including 16 on CD-ROM); 28 biographical sources; 35 book review indexes; and three general and 12 specialized statistical sources of local, national and international data. The Gateway presents all these sources on screens that have a common screen layout. Electronic resources are accessed by simple commands, thus making it unnecessary for the user to learn a number of different protocols. The Gateway software includes Hypercard 2.0, MAC/TCP, and Mitem-View, and runs on Apple Macintosh NCX computers, which are connected to the campus computer network.

Evaluation

In addition to being observed and interviewed by staff, The Gateway users filled out over 2,000 evaluation forms over the course of the project. This feedback was used to modify and refine The Gateway, and the response, which had been positive from the beginning, grew more enthusiastic with each improvement. Students were particularly pleased with the ease of access and the abundance and appropriateness of information provided by The Gateway. No attempt was made to compare the quality of research carried out with the assistance of The Gateway to that accomplished by traditional means.

Project Impact

Originally designed for use by lower division undergraduates, with each refinement The Gateway attracted progressively more sophisticated researchers, so that at present 32% of its users are graduate students, faculty and staff. Faculty are generally pleased with the effects of The Gateway on student work. The program has attracted interest at other institutions, and conversations with various marketing companies are currently underway.

Recognition

The Gateway project has received two additional grants from the Department of Education's College Library Technology and Cooperation Grants Program, and one from the William Randolph Hearst Foundation.

Project Continuation

The Gateway was originally available at only four library workstations. By the end of the project these had grown to 24, and eventually all 60 public workstations at the University Libraries will have The Gateway capability. The narrative is constantly being expanded and revised, and special subject sections are being added, such as Communication, Business, Women's Studies, and University Archives. The University's continuing support of this project may justly be attributed to the enthusiastic reaction to The Gateway on the part of students, faculty and staff.

Available Information

Inquiries about The Gateway should be addressed to:

Virginia Tiefel
Office of Library User Education
The Ohio State University Library
1858 Neil Avenue Mall
Columbus, OH 43210
Telephone: (614) 292-6151

SALEM STATE COLLEGE

Improving Teaching and Learning in Introductory Arts and Sciences Courses

Purpose

Disturbed by the frustrations of both faculty and students in certain freshman and sophomore courses that produced high percentages of student failures and withdrawals, the Director of Academic Advisors turned to the Supplemental Instruction (SI) Program model developed by Deanna Martin of the University of Missouri, Kansas City. The model seemed to hold promise not only for reducing failures in these "high risk" courses, but also as a vehicle for faculty development, making the courses more rewarding for faculty to teach.

The SI program sets up a regular schedule of out-of-class sessions in which groups of students work together to master course content. Leaders for these groups are drawn from among students who have successfully completed the courses that employ this model and have been nominated by faculty to serve in this role. The program thus focuses on the academic content of specific courses, helping students develop learning strategies for that particular content.

Project Activities

Salem State expanded the model by encouraging faculty teaching these courses to help interview, select and train the SI leaders. Faculty also attended monthly seminars where they shared their frustrations and discussed ways of dealing with the classroom problems they faced in common. Sessions ranged in format from guest

speakers to seminar members presenting ideas that worked, and at least once each semester the faculty group and the SI leader group met together. Thus faculty became familiar with the program and involved with the student leaders as colleagues participating in a common enterprise.

The trained student leaders attended all sessions of their faculty member's course and led voluntary supplemental sessions of two or three hours per week. At first, these sessions were likely to be attended by the better students who wished to improve their course performance, but the more marginal students eventually began to attend. (Faculty never knew until the course was over which students had attended these sessions.) Faculty were encouraged to meet with the SI leader once a week to answer questions or work together on instructional problems. Although these meetings were for the express purpose of having faculty help the SI leaders, nearly all faculty found that the leaders' reports on sources of student difficulty helped them adjust their instructional emphasis and strategies.

Innovative Features

While a number of out-of-class group study strategies such as SI have demonstrated their success, the kind of faculty involvement featured in this project is unusual. Faculty participation in training SI leaders and in all-faculty seminars turns an academic support activity for students into a faculty development effort as well. In the process, faculty begin to find solutions to pedagogical problems and to adopt a new attitude toward teaching courses in which student performance and intellectual challenge are unsatisfying.

Evaluation

Project directors kept detailed records of the course performance of students in all sections that offered SI support over a three-year period. The average grades of students participating in SI instruction were half a grade higher that the average of those not participating.

To address the argument that SI participants might be intrinsically better students than non-participants, grades in sections of the same course that offered no SI support were compared with those of SI participants. The results showed an average grade differential quite similar to that between SI and non-SI students in the same course.

Student attrition in these courses also declined. Thus, between the support provided by the SI leaders and the instructional changes introduced by faculty as a result of their program participation, a significant number of the courses moved out of the "high risk" category.

Faculty reaction to the experience was measured by a questionnaire administered before and after participation, and further assessed through voluntary interviews of half an hour to an hour at the conclusion of each year's activities. Results, both statistical and anecdotal, are quite encouraging. Faculty felt inspired by having the SI leader in their classes and found the feedback from the leader helpful. They felt that they had become better teachers as a result of the experience and were most satisfied with teaching introductory courses. They learned a great deal from the seminar about teaching more effectively.

Unanticipated Problems

Student SI leaders sometimes had trouble understanding the difference between tutoring and SI. The purpose of SI is to help students support each other in learning how to learn and in mastering course material, rather than to have the SI leader reteach the material.

Faculty sometimes had the same problem. Part of the problem lay in getting faculty to commit the two full days necessary to obtain a thorough understanding of the SI technique, which made for some difficulties in their supervision of the SI leaders in their courses.

Major Insights and Lessons Learned

SI works not only to improve student performance and reduce course attrition, but with the intimate involvement of faculty it can result in greater instructor satisfaction and pedagogical renewal. Faculty discover that their problems are shared by those in a variety of other disciplines and become more willing to work on them with the moral support of others in similar situations.

The experience of being an SI leader can have substantial impact on student development, building leadership skills as well as academic ones. In at least eight cases, the experience resulted in students choosing a teaching career they had not previously considered.

Project Continuation

Despite the unusually large budget reductions experienced by Salem State along with other Massachusetts institutions, campus funding continues and the program is quite active.

Available Information

The project produced several videotapes that will be of interest to others contemplating introduction of such a program. Several small pamphlets summarize the impact of the project on students and faculty.

These items and general information about the program are available from:

Douglas A. Larson
Department of Accounting/Finance
Salem State College
Salem, MA 01970
508-741-6664

or

Sherrin Marshall
U.S. Department of Education
Fund for the Improvement and Reform of
Schools and Teaching
555 New Jersey Avenue
Washington, DC
202-219-1496

All nine of these programs have as a common feature the creative adaptation of modern electronic technology, ranging from computers to programmable calculators to TV satellite transmission. The uses of this technology vary from simulations to self-instruction to practice, but all reflect pedagogical imagination applied to widely experienced classroom problems.

Six of the nine projects are in the sciences, and of the three non-science projects, two are in fields whose theory is strongly based in mathematics. It may be that the sciences lend themselves better to the kinds of instructional adaptations of technology that FIPSE has promoted; it may be that the teaching of science has been a matter of special concern to the disciplines in recent years; or it may be that successful short term learning outcomes are more readily demonstrable in the sciences. Whatever the reason, the predominance is notable.

Several of the projects are self-consciously based in contemporary learning theory. Thus they sequence learning differently from what has been the custom in the field, strive less for coverage and more for student independent discovery and understanding of basic principles, and promote active learning. Because in many cases microchip technology eliminates the drudgery or even the impossibility of complex calculations, changes are occurring in what gets taught.

All of these projects place the student at the center of the learning experience. The lecture has not become obsolete, but these strategies have the effect of reducing the faculty role in mediating learning and make it much more a matter of student effort and discovery. If students do indeed understand better and retain longer what they

discover themselves, the argument for wide adoption of such strategies is strengthened. Fortunately, the specific curricular and instructional materials developed through these projects have been demonstrated to be adaptable at many different kinds of campuses. Nearly all project directors report wide dissemination of their work, with several reporting controlled evaluations of their materials on campuses other than their own.

CLEMSON UNIVERSITY

Investigative Learning: A Plan for Laboratory Education

Purpose

Instructors of introductory biology for non-majors completely revised the laboratory portion of the first semester of the course to focus on the scientific investigative process. A set of student-designed and -executed experiments has replaced the familiar "cookbook" exercises for traditional laboratories. The new format aims to give students a better sense of the process of scientific investigation and, through extensive writing and oral presentations, to improve their communication skills. The project directors wished to accomplish these goals without negatively affecting student performance in the lecture course, which the traditional laboratories help to support.

Project Activities

Instructors have completely redesigned the laboratory portion of the course, substituting a computer simulation of commercial aquaculture and a series of student-designed "wetlab" experiments for traditional laboratory exercises. In support of the new approach, the project directors created extensive new instructional materials:

1) FISH FARM, a computer simulation challenging students to determine the economically optimum culturing conditions for a hypothetical new fish hybrid.

2) "Methods modules," consisting of: a videotape that demonstrates standard laboratory techniques; a student manual of step-

by-step processes to be followed in designing, carrying out and reporting an experiment; an instructor's guide; and a preparator's guide.

3) A writer's guide and writing exercises, produced in collaboration with members of the English Department.

Students begin the semester with the computer simulation. Teams of three or four students experimentally determine the best values for each of five culturing variables. The teams then test their conclusions by simulating five years of commercial operation under their predicted optimum conditions. Students using the same unknown fish compete against one another for the most profitable results. Finally, each student writes a FISH FARM report. The emphasis in grading these reports is on correct presentation and interpretation of the results, not on profit.

After completing FISH FARM, students begin the "wetlab" work. The teams formed for FISH FARM view videotapes demonstrating laboratory techniques. In consultation with their instructor, they devise an original investigation using one or more of the techniques and design an experiment. They present an oral research proposal to the class and modify their plans based on feedback from their peers. They then submit a materials list to the prep room, perform the experiment, and present their results orally to the class. Each student submits a written report. In the course of the semester, each team carries out three experiments.

Innovative Features

Laboratory courses in the sciences usually have the stated goal of improving students' ability to think scientifically by doing experiments

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and interpreting the resulting data. A secondary purpose is review and reinforcement of content covered in course lectures. All students perform the same exercises following highly detailed directions. They know in advance the outcomes they are to achieve, and they are required to explain these "correct" outcomes rather than think about what experiments to perform or how to perform them.

In the investigative laboratories designed and implemented through this project, students devise and report on their own experiments, following procedures much more like those of scientific investigators. In close collaboration with others, they define the question, structure an investigative process, choose appropriate investigative techniques, carry out the experiment, and report results in written and oral form. Grades are based on the quality of the process and of the written report rather than on a series of content-driven quizzes.

Such a laboratory program is rare because it is difficult to implement. The low skill levels of students, the unpredictability of lab material requirements, the lack of time for thoughtful development of experiments and the additional demands on the creativity and resourcefulness of instructors all militate against this strategy.

Evaluation

The project aimed to improve the knowledge and skills of students about the experimental process, and to enhance their writing without sacrificing mastery of subject matter. The design of the evaluation was simplified by the fact that a number of lab section instructors, all of whom were graduate assistants, taught both investigative and traditional labs.

This allowed the separation of students into three groups: those in investigative sections taught by instructors who also taught traditional sections; those in these same instructors' traditional sections; and those taught by instructors who taught only traditional sections. Mean lecture examination scores for the three groups showed no significant difference, demonstrating that students in investigative labs were able to master course content as well as those in the traditional labs, one of whose purposes is to reinforce lecture content.

On the other hand, students in the investigative sections did not do better on test questions about process skills or the nature of science than those in traditional sections. Neither pre-test nor post-test results showed any significant difference among the three groups. A test of experimental design ability disclosed investigative superiority in some areas, but no significant difference in overall scores. Nor was there much difference on a test of writing, but the fact that the results of all groups were worse on the writing post-test than on the pre-test suggests that students did not take the post-test seriously since they knew it would not be part of their grades.

Student opinion tended to be quite favorable toward the individual parts of the investigative structure but negative toward the whole, largely on the grounds that it was much more demanding and time consuming than the traditional sections. On the other hand, positive response to the wetlab manual, to FISH FARM, to the writing guide and the videotapes as well as to the freedom to devise experiments ranged from 50-75%. A majority agreed that they were more confident in their abilities to analyze problems scientifically, design experiments, analyze data and present their conclusions orally and in writing. The majority did not agree that they would have learned more about science in a traditional section.

Although the more negative global response clearly focused on the work demands, perhaps it also resulted from what beginning students believe to be the nature of learning. Because the lab sections had more to do with understanding a process than with memorizing facts, students were not clear about just what it was they had learned.

Laboratory instructors were uniformly enthusiastic about the project from the beginning, and rated it highly with regard to their perceptions of student growth in the skills the course aimed to impart. They were concerned about the investigative students' understanding of the experiments but were equally disappointed in the traditional students' comprehension of the lab exercises. All but one thought the investigative labs required a higher level of effort, but that did not dampen their enthusiasm for the method.

Although the laboratory preparators initially found that the investigative labs made their task more difficult, once they developed new ways of organizing their work they felt quite comfortable. A minority of the faculty remain concerned that the review of lecture course content provided by the traditional labs has been lost.

Project Impact

The project has been well received among faculty and administrators at Clemson and seems likely to be fully institutionalized. Because teaching the investigative sections is more demanding, two such sections are considered a full load for teaching assistants, as opposed to three sections of the traditional laboratories. The need to increase the number of TA's is the only barrier to full adoption of the investigative mode.

The project's impact at Clemson will be increased by some additional funding. In summer of 1992, the investigators received a National Science Foundation (NSF) grant to extend the investigative format to the second semester introductory laboratory course. (FIPSE funding only influenced the first semester course.) The funding will allow development of new exercises which are sufficiently flexible to make an investigative format worthwhile.

In a broader sense, the most important result of the project is that this approach to laboratory instruction is practicable even in an introductory course for non-majors. Such a course precisely fulfills one major purpose of a general education science course: to give students a sense of the nature of the scientific enterprise.

This project has generated interest on the part of teachers at other institutions. Portions of the course and course materials have been adopted by a local community college. Presentations at professional meetings have been well received, including a detailed presentation at the conference of the Association for Biology Laboratory Education. An NSF-funded workshop in the summer of 1990 drew 30 participants who, after five days, agreed unanimously that the work was useful to them and that they planned to implement investigative labs at their own institutions. Many have in fact done so, some using materials from this project.

The project has received two grants from NSF, one for the workshop mentioned above and another for video and computer equipment. A 1992 NSF grant will allow extension of the investigative format to the second semester course.

At the invitation of a commercial publisher, one of the project directors is producing a lab manual. The other project director is

publishing FISH FARM with the same company.

Major Insights and Lessons Learned

In addition to being practicable, investigative laboratories are more interesting to teach than traditional ones. They cast instructors in the role of research mentors, teaching students the characteristics of a good scientific investigation and then helping them apply those principles to the work they want to do. Investigative laboratories can also offer interesting surprises when a student experiment turns up unexpected results.

Available Information

Project directors will send a general description of their implementation plan, including the lab syllabus and a summary of evaluation results. The laboratory manual and computer program are currently being prepared for commercial publication. Request materials from:

Robert J. Kosinski
Biology Program
330 Long Hall
Clemson University
Clemson, SC 29634-1902
803-656-3830

CLEMSON UNIVERSITY

Revitalized Undergraduate Mathematics with Symbol Manipulating Graphics Calculators

Purpose

High-level programmable Hewlett-Packard calculators may afford students, for the first time, real graphical, numerical and symbolic computing power that is reliable and portable. But most freshmen and sophomores in undergraduate mathematics are still computing with pencil and paper, even though new computational devices are available. The goal of the project was to integrate these graphics calculators effectively into six service mathematics courses for science and engineering: single-variable calculus (two courses), multivariable calculus, differential equations, linear algebra and statistics.

Innovative Features

Clemson's ambitious experiment took aim at the actual character of undergraduate mathematics instruction and learning. Reshaping the service courses for science and engineering students with the use of "supercalculators" would give them the power to do symbolic algebra and sophisticated graphics, and to use interactive operating modes in class. Instruction would move away from stressing manipulation skills and toward enhancing conceptual understanding.

Prototype and pilot versions of the six courses were designed and tested with the following questions in mind: Where is calculator use

appropriate? How does calculator use affect efficient coverage of course material? Can calculators enhance conceptual understanding and allow new topics of study?

Hewlett-Packard lent the project 95 graphics calculators, and Clemson's administration provided another 85. Students made almost daily use of them for both classwork and homework, which allowed them to explore and experiment as they studied core theory and methods, to get immediate feedback from instructors, and to interact in class in new ways.

Evaluation

No objective measures of student learning, such as comparison of group performance on common tests, have been undertaken. Matching student groups by ability, math background, and skill levels was very difficult. Because the powerful calculators allowed theoretical questioning as well as computational questioning, students taught in the traditional mode were found to be at a great disadvantage when tested without calculators at their side.

Instead of using objective measurements, faculty observed classes, evaluated course materials (syllabi, handouts, and tests), and interviewed and surveyed 969 students in 39 classes about mathematical understanding, problem solving and exploration using the graphics calculators.

Project Impact

The claims of success for this project, then, are not based on comparative learning scores. Rather, project staff claim that the calculators, more than anything else, changed not only what they

taught and how they taught it, but how and what they tested, and how students learned. The unique dynamic introduced into the learning process by these calculators "encouraged the students to learn--and the faculty to teach--the concepts and methods in a more active, constructive environment from analytical, graphical and numerical perspectives."

The integration of the graphical and numerical solve features of these devices has enabled students to make important visual and numerical connections to the analytic presentations in the texts. The technology, then, removed the traditional routine computation and permitted more thinking about the underlying mathematical concepts and theories.

Having observed students in class, faculty claimed that the way students learned was fundamentally changed by the integration of graphics calculators--that they developed strategies to generate, manipulate, and use visual images in the process of understanding math concepts, whereas in the past, visualizations had been largely a product of students' mathematics.

The supercalculators allowed the successful introduction of two modern topics which often could not be covered in previous offerings into the linear course: the interpretation of Gaussian elimination as an LU-factorization and its application to linear systems with multiple right-hand sides, and the interpretation of the Gram-Schmidt process as a QR-factorization and its application to least squares problems. In these cases, students were able to grasp and handle complex contemporary math concepts, something that had not occurred in the past. However, data from a carefully controlled experiment to this effect are not available. A new level of testing on new topics has been

opened up through using graphics calculators that is not possible in a more computationally restricted environment.

In interviews and questionnaires, the majority of students across all experimental courses reported that the graphics calculators helped them understand because they could visualize the mathematical relations by use of graphs. Almost all students claimed that the graphics calculators were useful in solving problems, often because of their ability to store programs to be recalled later for complex solutions. Students also said that they sensed the opportunity that graphics calculators gave them to explore and investigate beyond what they could achieve without them. Class attendance in the calculator-enhanced classes was dramatically higher than in other sections.

Clemson faculty have felt the impact of these reforms as well: the first seminar on teaching within the math department in over 20 years grew out of pedagogical issues surrounding these new courses. Currently, instructors meet in three seminars every week about each of three courses. Growing acceptance of the experiment from Clemson administrators and faculty is reflected in the number of calculator sections over time: 6 in 1988-1990, 33 in 1990-1991, 52 in 1991-1992, and 56 in 1992-1993.

This project was selected in 1990 by the Mathematical Association of America as one of the ten exemplary mainstream calculus reform projects in the nation, and was specifically featured in its publication, Priming the Calculus Pump: Innovations and Resources.

Project Continuation

By the end of the 1991-1992 academic year, 3,500 students and 26 math instructors had studied calculus, differential equations, linear

algebra, and statistics in calculator-enhanced classes. The project is firmly institutionalized within the Clemson curriculum, with plans to substantially expand the program through National Science Foundation funding. A recent award to Clemson and the Georgia Institute of Technology from NSF will extend and adapt the methods and materials across the two campuses.

Currently, the 52 calculator-enhanced class sections represent about one-half of all offerings in science and engineering for undergraduates. By the fall of 1994, the project plans to integrate the calculator technology into two new areas: 31 sections and 1,000 students in college algebra and precalculus courses, and 55 sections and 2,100 students in business calculus courses.

Project faculty have given approximately 135 presentations, many of them by invitation and including the nation's foremost math and technology conferences. A growing list of colleges and universities, including Duke University, the University of South Carolina, Lock Haven University, and several technical colleges in South Carolina and community colleges in New Jersey have adopted the project's methods and materials.

Based on this path-breaking work in improving calculus instruction, FIPSE has recently funded another three-year project at Clemson, this time for revitalizing nonstandard calculus, the calculus taken by students in economics, management, business and the social sciences.

Available Information

In 1992 the project faculty published a series of five course supplement books through Harcourt Brace Jovanovich and Saunders College

Publishing on the pedagogical use of high-level graphics calculators:

Iris Brann Fetta, Calculator Enhancement for Introductory Statistics, 1992.

D.R. LaTorre, Calculator Enhancement for Linear Algebra, 1992.

T. G. Proctor, Calculator Enhancement for a Course in Differential Equations, 1992.

J. H. Nicholson, Calculator Enhancement for Single Variable Calculus, 1992.

J. A. Reneke, Calculator Enhancement for a Course in Multi-Variable Calculus, 1992.

Twenty-seven articles have been either published or are forthcoming in an array of math and other professional journals on the local and national impact of the experiment. Several manuals on the use of graphics calculators in algebra, precalculus, and statistics will also be published this year by Harcourt Brace.

For more information about the project and its publications, contact:

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Clemson University
Clemson, SC 29634-1907
803-656-3437 FAX: 803-656-5230
e-mail: latorrd @clemson.clemson.edu

DENISON UNIVERSITY

Improving the Economics Curriculum with Laboratory Experiments

Purpose

The work that economists do has changed radically in recent years. Whereas in the past they concerned themselves principally with theory, refinements in methodology and accessibility of statistical and forecasting software have imparted a markedly empirical character to the profession. The teaching of economics, however, has not kept pace with these changes. In the classroom, the approach is still overwhelmingly theoretical, delivered mostly through lectures, with an occasional session devoted to discussion.

The Economics Department at Denison concluded that the best way to help students learn to think like economists was to give them experience with the problems and situations that economists confront every day. In the course of designing these experiences, the faculty established the first laboratory economics curriculum in the nation.

The entire Department participated in the elaboration of this curriculum, which was developed and phased in over a period of two and a half years. The Department added a laboratory component to eleven of its offerings, three of which are core courses, thus ensuring that majors graduate with a minimum of four laboratory courses.

Innovative Features

In the laboratories students systematically gather and use empirical information to discover economic principles at work, to test the usefulness and validity of the theory developed in the lectures and discussions, and to make informed and reasoned decisions about economic activity and policy. Denison's economics majors emerge from their studies possessing empirical exposure across the curriculum in addition to a theoretical analysis core.

Evaluation

The Department designated one of its members as evaluation director for the project. With the assistance of outside consultants, faculty designed an evaluation plan that included traditional evaluations of cognitive results and alternative approaches to measuring affective changes.

The performance on the Test of Understanding of College Economics (TUCE) on the part of 73 macroeconomics students who had been taught in the traditional lecture format in 1980 was compared to the performance on the same test by 80 students who took macroeconomics with the laboratory component in 1990. The TUCE was administered at the beginning and at the end of the courses. Both generations of students had basically equivalent backgrounds, and were taught by the same instructor.

Students also took two sets of value and attitude inventories, one normed on high school graduates and one on professional economists. In addition, the Department devised its own survey of the ways in which students' reading habits, attention to news, and course and career choices change in the three years of study for the major.

Major Insights and Lessons Learned

Preliminary results of the comparison of performance on the TUCE suggest that the laboratory has a significant effect on student learning. Students who took macroeconomics with the laboratory component showed a positive change of 10.7% between pre and post-test scores. The scores of students who did not have the benefit of the laboratory showed an increase of only 4.2%.

In the affective realm, equally marked changes have become evident. The professional attitudes survey indicates that students who took laboratory courses did indeed begin to think more like professional economists. In the classroom, faculty find that these students write more and better papers, and undertake independent studies and honors projects. They use empirical evidence more effectively and are more enthusiastic about their major than their predecessors.

Perhaps due to the more personal atmosphere brought about by laboratory interactions, the number of women economics majors has increased from about 35% to a little over 50%. Likewise, the number of minority economics majors has increased from four or five a year to ten or fifteen. Furthermore, the laboratory has become a gathering place for all students, who are cementing their new-found sense of community by resurrecting defunct clubs and organizations.

The project has brought about a revitalization not only of every course in the curriculum, but of faculty as well. A new style of collegiality has emerged as young instructors assist senior professors with computer use. The laboratory format has also fostered a more personal relationship between faculty and students.

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Unanticipated Problems

It is tempting for faculty engaged in laboratory design to produce simply another form of computer assisted instruction, with closed-end exercises that are easy to grade. As Denison faculty gained more experience, they became better able to use generic software to create "discovery" laboratories or simulations in which, for example, students reason from the findings of data analysis to develop new (to them) theoretical approaches to economic problems. It is in these labs that students learn that received theory does not always explain observed phenomena.

Project Continuation

The lecture/laboratory curriculum has been formally put in place by the Denison governance system. Only the introductory economics course has been omitted from the lecture/laboratory format, due to staffing limitations and because this course satisfies a general education requirement. Two additional laboratory courses have been formulated, and a new social science freshman course, team-taught by economics, sociology and anthropology faculty, uses the empirical approach first adopted by the Economics Department.

Recognition

Denison's economics curriculum was highlighted by the Association of American Colleges at its 1990 national meeting. The Economics Task Force Report included in the AAC's Liberal Learning And The Arts And Sciences Major recognizes Denison's program and one other--out of a survey of 400--for excellence in undergraduate instruction. This report has been published in The American Economic Review and in the Journal of Economic Education.

Many institutions have shown interest in adapting the lecture/ laboratory Economics curriculum. Based on the curriculum's success, one of the project directors was invited to testify before a Senate Subcommittee on the effectiveness of FIPSE grants.

Available Information

Denison University will make available copies of the grant proposal, of the various reports from the American Economics Association and the Association of American Colleges Economics Task Force, and of several publications of preliminary results.

Requests should be addressed to:

Robin Bartlett
Department of Economics
Denison University
Granville, OH 43023
614-587-6245

DICKINSON COLLEGE and TUFTS UNIVERSITY

Workshop Physics and Tools for Scientific Thinking

Purpose

The average introductory physics textbook is 1,000 pages long. The average physics student emerges from his first course in a state of cognitive overload, retaining at best a few formulas and definitions, and clinging to some of the very misconceptions about physical phenomena that the course was designed to dispel.

The Workshop Physics project at Dickinson College and the Tools for Scientific Thinking project at Tufts University were conceived to address the problems of teaching and learning introductory physics. Project faculty determined that these courses should prepare students for further study of physics and other sciences and should enable them to become proficient in the use of computers and other research tools. Most importantly, introductory physics courses should whet students' appetites to learn more science.

The projects, which originally were funded separately by FIPSE, merged in their third year.

Innovative Features

The Workshop Physics project resulted in the creation of two two-course sequences, one in calculus-based introductory physics and one in algebra-based physics. The principal dilemma confronting introductory physics instructors is choosing what to teach and how to teach it: relativity, quantum theory and chaos vs. Newton's Laws and

classical thermodynamics; new pedagogies based on cognitive theory vs. traditional instruction; and the digital computer vs. the electronic calculator. Accordingly, one of the faculty's most significant decisions was to reduce the amount of information delivered to the students in favor of enabling them to acquire transferable skills of scientific inquiry.

The choice of which topics to retain in the syllabus was based on the extent to which these lent themselves to direct observation, and to the broad applicability of the mathematical and reasoning skills required to analyze these observations. Topics such as relativity and quantum mechanics, which require levels of abstract reasoning beyond the abilities of beginning students, were eliminated.

Since all pedagogical decisions were oriented towards the goal of teaching students to think scientifically, lectures and demonstrations, whose value lies in transmitting information rather than helping students to reason like scientists, were abandoned in favor of direct inquiry and discussion.

The microcomputer is an essential tool in this approach. Not only can students work scientific operations quickly, but a microcomputer connected to a sensor (such as an ultrasonic motion detector, photogates, temperature sensors or geiger tubes) via an electronic interface can perform instantaneous calculations and produce graphs. The use of a microcomputer-based laboratory (MBL) to produce a time trace of the position of a student's body, for example, can help that student grasp intuitively how a graph represents the history of change in a given parameter.

Evaluation

Using essays, homework and laboratory completion rates, performance on various tests, and interviews, project faculty measured student attitudes, conceptual development, problem-solving abilities, and computer and laboratory skills. The most fruitful procedures included a comparison of student ratings on the all-college rating system which has been in use for ten years at Dickinson; a survey of course management practices and student attitudes administered to over 3,000 students at 22 institutions; and pre- and post-tests of introductory physics students over a period of four years. Although, given the volume of evaluation data, analysis is not yet complete, the project has yielded significant gains among the more than 250 Dickinson students who have completed Workshop Physics courses since 1987.

Attitudes towards the study of physics have improved, as shown by the numerical ratings of calculus-based Workshop Physics students on the standard all-college evaluation forms. About two-thirds of the students in these courses express a strong preference for this method over the lecture approach, and enrollments in advanced courses have increased by 15-30%. Results for the algebra-based courses serving premedical students are less positive--only half of the students in these courses prefer the workshop approach.

Because of the direct experience with phenomena allowed by Workshop Physics, a greater percentage of students master concepts that are usually considered difficult to teach because they involve classic misconceptions. For example, Dickinson students show significant gains in graph interpretation skills needed for the study of kinematics after learning to interpret velocity graphs by producing

graphs in real time on a computer screen with the aid of an MBL motion detector system. On the other hand, Tufts University students who listened to traditional kinematics lectures did not show a significant reduction in error rates.

Although the conceptual gains of Workshop Physics students are greater than those achieved by students taking conventional physics courses in many topic areas, the gains are not universal, and in certain areas Workshop Physics students perform no better that their traditional peers.

Student performance in upper-level physics courses and in solving traditional textbook problems is as good as or better than that of students in the traditional curriculum. Moreover, Workshop Physics students demonstrate a comparatively greater degree of comfort working with computers and other laboratory equipment.

Regardless of format, female students react less positively to the study of physics than males. Nevertheless, women who enroll in Workshop Physics make proportionately greater gains than males in their appreciation of the use of computers. Despite women's supposed dislike for hands-on work, female students continue to comprise 30% or more of the physics majors at Dickinson.

Some students perceive Workshop Physics as taking more time out of class than the traditional approach, although surveys demonstrate that this is not in fact the case. A small number of students dislike the hands-on approach, and would much prefer a textbook and lecture-oriented pedagogy.

Project Impact

Despite the adjustments in schedule and teaching style required initially (the courses are taught in three two-hour sessions per week rather than the traditional three hour-long lectures and single two- or three-hour laboratory), Workshop Physics is now regularly offered at Dickinson. The amount of national attention the courses have attracted has helped to make them popular with students, faculty and administrators. Nevertheless, instituting academic change is a laborious and time-consuming process.

The assessment of a project such as this one can become problematic if it is not tied carefully to evaluation of students for grading purposes. Improperly planned assessment can yield mountains of unanalyzed data, and can rob faculty of valuable time.

Workshop Physics has so far resulted in impressive gains for students, yet much remains to be learned about how individuals learn different scientific topics. Workshop Physics is certain to continue to generate subjects for investigation and reflection for years to come.

Recognition

The project has received a number of national awards, such as the Merck Innovation Award in Undergraduate Science Education and an EDUCOM/NCRIPTAL Award for Best Software in Physics. The Director of Workshop Physics, Priscilla W. Laws, was awarded a Distinguished Service Citation from the American Association of Physics Teachers. The project has garnered close to three million dollars in additional grant funds from FIPSE, NSF and IBM.

Project Continuation

The developers of Workshop Physics are collaborating formally with faculty at the University of Oregon, Ohio State University and Rutgers University in the adaptation and testing of Workshop Physics and Tools for Scientific Thinking materials. Over 50 other institutions use these materials to various degrees and have adapted the project's curriculum to their own needs.

In addition, the project has attracted the attention of faculty from chemistry, biology and mathematics at several colleges and universities. Their joint interdisciplinary efforts include designing software, devising uses for the laboratory technology, and testing. At Dickinson, a new Workshop Mathematics program, recently funded by FIPSE, is investigating ways of adapting Workshop Physics to mathematics instruction.

Available Information

Copies of articles about Workshop Physics, and information regarding workshops for faculty interested in learning this approach may be obtained from:

Virginia Trumbauer
Department of Physics and Astronomy
Dickinson College, Box 1773
Carlisle, PA 17013-2896
717-245-1845
Internet: TRUMBAUE@DICKINSON.EDU

Copies of the Workshop Physics Student Activity guides, both calculus-based and algebra-based, as well as an apparatus guide are

available in both printed and electronic formats for MacIntosh computers. The cost is nominal and purchasers are granted permission to modify and/or reproduce materials locally. The Microcomputer-Based Laboratory apparatus, including a serial interface, sensors, and MacIntosh software developed jointly at Tufts University and Dickinson College are also available for purchase.

Price lists and ordering information are available from:

Vernier Software
2920 SW 89th Street
Portland, OR 97225
503-297-5317
Fax: 503-297-1760

UNIVERSITY OF MARYLAND, BALTIMORE COUNTY

The Satellite Development Project in French Language and Culture: France-TV Magazine

Purpose

The project had four goals: 1) to fill the need in French language and area studies for culturally authentic, lively materials received in the classroom in a continuing fashion; 2) to create a model of television satellite-assisted instruction that would foster a communication approach to the teaching of foreign languages; 3) to produce and distribute nationwide and on a monthly schedule supporting instructional materials; and 4) to disseminate this high tech instructional system in such a way as to make it financially self-supporting.

Project Activities

The medium through which these purposes are carried out is France-TV Magazine, a cooperative effort of France 2, the leading French TV public network; Mediane Films, a small production company; and the University of Maryland, Baltimore County (UMBC). The 60-minute satellite-transmitted television program consists of major news stories of the past month assembled from the network's broadcasts, and features on contemporary France and Europe. The magazine appears monthly during the academic year. The broadcasts are accompanied by a study guide and teaching resources assembled by a team of UMBC staff and school teachers.

In the second year of the project, marketing and distribution, including both print and diskette versions of the instructional support materials, were taken over by the Public Broadcasting Service (PBS). Soon after, secondary distributors (for example, Sat Link in Missouri and station WIZ in Cleveland) started to set up local computer bulletin boards (BBS) listing program updates and providing a medium for the exchange of pedagogical ideas.

The TV Magazine and support materials were made available in a variety of versions and in a number of different formats. They could, for instance, be obtained in libraries and in a home video form.

Innovative Features

The project is unusual in its provision of current authentic materials supported by at least 65 pages of instructional text per program, thus constituting a unique language and culture video "textbook." France-TV Magazine has also developed a practical "step-by-step" video-based pedagogy specially designed for immediate use in the classroom. Widely distributed, the France-TV Magazine concept has reached quite a remarkable viewership. Indeed, in 1993, France-TV Magazine is in use in well over 200 colleges and universities, resulting in an estimated half-million viewers annually. Secondary school students in 200 cities in 35 states have access to the program, as does the general viewing audience for the PBS affiliates and cables carrying the program. The overall potential audience has been estimated at over 70 million viewers.

Evaluation

Teacher responses and ratings have been gathered systematically regarding 1) the situations in which France-TV Magazine has been

used, 2) the features of the program that have been selected, and 3) the aspects of language learning on which the material has had the most influence.

It was found, for instance, that only short video segments (no more than four minutes) should be used in the foreign language classroom. Subjects dealing specifically with youth: lifestyles, issues, etc., and the French educational system were in demand, and they were therefore enhanced in the program. The questionnaires also included the evaluation of technical aspects of the program such as the quality of picture and sound reception. Students were not asked to rate the materials. However, each innovation in France-TV Magazine's pedagogical approach was carefully tested in the classroom before being integrated in the support materials. The acute emphasis on the importance of contextualization and preview activities was a result of these in situ experiments.

The continued involvement of PBS and the System's efforts to make France-TV Magazine a self-supporting operation are a strong endorsement of the quality of the work and its real usefulness to a broad audience.

Project Impact

The video magazine has had its greatest utilization in classes at the intermediate and advanced levels. It provides authentic materials which help students understand how the language is used in France today in its fully nuanced form, teaching not only the content of the culture but reinforcing the idea of language as both a cultural artifact and a carrier of culture. Thus, the materials have proven an extremely valuable support for principles and strategies of language

teaching that are rapidly becoming the norm in the foreign language classroom.

The electronic Bulletin Board Service, originally intended as the medium of distribution for the pedagogical materials, has become instead a means of conveying information about future programs and allowing users to exchange ideas, organize conferences, and trade teaching tips. The pedagogical materials are now available as print materials and IBM-compatible diskettes.

The goal of making the service self-supporting was finally reached in 1992 when UMBC took over the distribution of videocasettes and was able to retain all the income from that source rather than sharing it with PBS. In order to reduce the cost of the magazine service and thus expand the audience, some specially produced cultural material had to be dropped. Target segments in all levels were developed as user samples.

Major Insights and Lessons Learned

The growing use of France-TV Magazine at a full range of colleges and universities and at over 1,000 schools reached through 327 PBS affiliates nationwide has demonstrated the need for such a program. Over the years, however, authentic materials have proven to be most valuable only if carefully selected and accompanied by support materials.

In order to make France-TV Magazine self-supporting, a leaner, less high tech version than the original project was developed to keep down costs and expand the audience.

Recognition

France-TV Magazine is now the official program of the Délégation Générale à la Langue Française in Paris. Since the production is now entirely funded by the Ministere des Affaires étrangères, the program is distributed to all French cultural services, in more than one hundred countries, and is present on the five continents. The program is being aired in both Americas, Japan, Tanzania, the former USSR and throughout Europe. Negotiations are still taking place in Paris to widen even further France-TV Magazine's audience.

France-TV Magazine won two red ribbon awards at the 32nd and 34th annual American Film and Video Festival in San Francisco and Philadelphia.

Available Information

Information about satellite reception for colleges, universities and high schools is available from:

PBS Adult Learning Satellite Service
1320 Braddock Place
Alexandria, VA 22314
1-800-257-2578

Information about pre-recorded videocasettes is available from:

France-TV Magazine
AC-IV, Room 146
University of Maryland, Baltimore County
Baltimore, MD 21228-5398
1-800-992-3788 or
410-455-2963

General information about the project is available from:

Claud Du Verlie
Department of Modern Language and Linguistics
University of Maryland, Baltimore County
5401 Wilkens Avenue
Baltimore, MD 21228
410-455-2130

NEW MEXICO STATE UNIVERSITY

Overview, Case Study Physics

Purpose

Overview, Case Study Physics, is a "spiral" form of instruction in introductory physics based on the last two decades of cognitive and physics education research. The course is divided into a small number of conceptual blocks. Each block begins with an overview in which students construct or acquire a qualitative understanding of the basic physical processes under study using diagrams and graphs. In the second part of the block, students learn the mathematical representations of the same concepts, using words, sketches, diagrams, graphs and basic equations. They then learn to shift back and forth between the various forms of representation. Following this "exposition" section, students solve case study problems involving the integrated use of knowledge introduced earlier in the course. The overview-exposition-case study process is then repeated for the next block of material. Throughout, students spend the majority of the class time working together in small groups.

Innovative Features

Instruction systematically incorporates pedagogical techniques whose validity has been consistently confirmed: active learning; collaborative learning; presentation of subject matter in a variety of forms, both qualitative and quantitative; presentation of ideas in successively more sophisticated forms at increasing levels of complexity; and careful sequencing of ideas.

The course approach is presented in a study guide and a set of 300 Active Learning Problem Sheets (ALPS). The former supplements the standard text, and contains materials for the overviews, activities to support the multiple representation problem solving, and case study problems.

The ALPS Kit helps students organize their thinking, reason qualitatively about physical problems and change the representation of a problem. It can be used for collaborative learning during the class period, for homework assignments or for quizzes. Some of the case study problems require students to divide problems into parts and give definition to poorly defined problems, thus giving students experience at the introductory level in solving unstructured problems.

Evaluation

Strikingly superior student performance using the overview, case study (OCS) approach as opposed to standard lecture approaches has been demonstrated in five institutions of different types. In courses using standard strategies, student gains in understanding, as measured by pre- and post-tests, are small and independent of instructor style and ratings. Gains registered by students in OCS courses, on the other hand, are not only several times greater, but 75-80% of those who begin the course finish it, as opposed to about 60% in the conventional courses.

Other studies of the comparative results of the OCS approach have shown that:

1. OCS students do better than traditional students in absolute end-of-course test scores.

2. Students taught with the OCS strategies retain their learning better, as measured by a diagnostic test given at the beginning of the second semester course two semesters after the first course was completed.

3. Students in an interface course offered for poorly prepared students and using the OCS approach performed better at the end of the course than students in the regular course. (The problems on the comparison test were written by faculty associated with neither course.)

4. Students in OCS sections do markedly better than traditional students on a final examination made up of problems written by instructors in traditionally taught sections of the same course.

Ratings of student satisfaction with the course are extremely high--9.2-9.8 on a 10-point scale.

Project Impact

The materials have been used successfully at a variety of institutions, from state colleges and universities to technical colleges and two-year colleges, but seem to have found particularly wide acceptance at the latter. The project director has conducted workshops and colloquia at NSF-sponsored workshops for community college teachers, at meetings of the American Association of Physics Teachers, at ten U.S. universities and in South Africa. Estimates are that 20 or more institutions are currently using the materials.

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Major Insights and Lessons Learned

The oversight and case study method of instruction clearly demonstrates the value of paying attention to specifically relevant research on student learning. By designing a course that responds systematically to the clues coming from research findings, the project has yielded an instructional approach that produces demonstrably superior student outcomes and high student satisfaction.

Recognition

The OCS approach was included in the Introductory University Physics Project of the American Institute of Physics, which disseminates outstanding new instructional developments to the discipline. To join the Physics Project, instructional models had to be rated by a panel of physics professors in the top ten of those presented. The OCS model received the highest ratings of all.

Project Continuation

Use of the OCS approach continues to grow. Several publishers are considering production of a text based on the model. The ALPS Kit is now being used in the lecture and recitation parts of the introductory physics course for engineers at Ohio State University. The project director recently received an NSF grant to develop a series of laboratories and lecture experiments building on physics education research. He will integrate these new lab activities into future FIPSE labs at Ohio State University.

Available Information

Information about the course and sample materials may be obtained from:

Alan Van Heuvelen
Department of Physics
The Ohio State University
174 West 18th Avenue
Columbus, OH 43210-1106
614-292-5713
FAX: 614-292-7557

NORTHWESTERN UNIVERSITY

Redesigning the Content and Sequence of Instruction in Music Theory

Purpose

To the faculty of the Northwestern University School of Music, the way music theory is usually taught--note by note and chord by chord--seemed to run counter to the way in which music is apprehended and appreciated by seasoned musicians, as a coherent whole rather than as the sum of disparate fragments. Simply put, where traditional theory instruction proceeds from the bottom up, real musicians approach compositions from the top down.

The faculty envisioned the process of musical comprehension and performance as a problem-solving task that includes aural, visual, kinesthetic, affective and chronological components. Accordingly, they set about developing a multi-media, real-time instructional approach that would allow the students to perceive these elements as an integrated whole.

The project focused on the freshman core curriculum, which consists of courses in musicianship and aural skills. Faculty identified four strategies that would result in the kind of musically sophisticated grasp of compositions that they wanted students to achieve. Each of the four strategies--memorization of compositions, modeling of musical structures through creating programs which "compose" these structures, analytic reading of musical scores, and analytic listening--became the province of a particular faculty member. Each strategy required in-class paper and pencil work on the part of the students, and all

but the first one involved use of MacIntosh software developed by the faculty.

Two of these software systems, the ScoreScan/Imager system for teaching analytic reading scores, which includes a library of 200 scores for practice, and the EarWorks system for designing and delivering analytic listening lessons with commercial audio CDs, are now in regular use at Northwestern. The School of Music anticipates publishing the analytic listening and score analysis materials as textbooks and as computer-assisted instruction software for wider distribution.

As initially envisaged, the freshman curriculum was to revolve around a few core compositions which the students would visit time and again from different points of view. The computer would allow them to manipulate the music in a variety of ways, including revoicing and reorchestrating, and to compose new works based on the models studied.

Evaluation

Each aspect of the project was evaluated by the faculty member in charge of its development, and as a result, some changes were made to the original curriculum. Memorization was dropped after one term, without the benefit of formal appraisal, since faculty and students agreed that the musical gains were not worth the laboriousness of the approach. The modeling of musical structures through programming was also discontinued, since although students became adept at writing about their discipline, the musical quality of their projects was relatively low, and they spent a disproportionate amount of time working out programming difficulties.

In the analytic score reading component, students were given a pre-test in which they attained a mean of 57.3. The mean for quizzes administered during the course was 90.0. Even though this constitutes a comparison of different instruments, faculty believe that it confirms their own sense of students' improved abilities in reading scores.

Progress in analytic listening consists in moving from an initial perception of a musical work as a succession of events to a more synthetic apprehension of structural relationships between non-adjacent points in the work. In this component of the project, students' responses in a listening exercise at the beginning of the year were compared to their responses in a similar task two quarters later. In the initial exercise students commented mostly on descriptive features of the composition, such as a timbre and rhythm. In the later exercise, however, comments on the sonic and kinesthetic properties of the work decreased, and remarks on the formal qualities of the composition, such as harmony and melody, increased. This is all the more significant in that the exercise did not explicitly call for comments on structural features.

Analysis of qualitative data--student performance protocol and transcript files--has not been completed, but general observations tend to confirm the developments outlined in the listening exercises.

Major Insights and Lessons Learned

To the faculty who devised it, this project demonstrates the soundness of the "top-down" approach and the usefulness of computers in aiding students to progress towards a higher level of musicianship. Whereas initially the faculty had expected that a comprehensive curriculum centered on the computer would result, experience made it obvious that it was wiser and more realistic, given time and political

constraints, to reserve the computer for very specific, high yield applications.

Recognition

The project, which has prompted a score of papers and presentations, has attracted attention from a number of institutions, including Yale University, the Eastman School of Music, the University of Michigan, Indiana University, the University of Illinois and Arizona State University. The success of the software designed in conjunction with the project has enabled the School of Music to obtain funds for its MacIntosh laboratory from the Kemper and Wurlitzer Foundations as well as other private and corporate sources.

Available Information

Syllabi and course-related materials as well as copies of papers and presentations may be obtained from:

Richard Ashley
School of Music
Northwestern University
711 Elgin Road
Evanston, IL 60208-1200
708-491-5431
email ric@music.nwu.edu

UNIVERSITY OF OREGON

Biology Laboratory Construction Kit With Intelligent Tutor

Purpose

Previous computer simulations used for instruction in introductory biology have employed models of a single fixed biologic system, for example, simulations in physiology for medical students. This focus on particular systems did not permit introductory-level study of cardio-respiratory systems across species, phyla or kingdoms.

The purpose of this project was to overcome these limitations by developing a computer toolkit and intelligent tutor that would place students in a flexible computer environment for learning basic concepts of a variety of circulatory systems. Students generate hypotheses, design experiments, test realistic simulations and learn how their constructions meet or fail to meet design objectives. The program invites investigative thinking, and particularly develops the ability to draw conclusions and unravel causality.

Innovative Features

The project attempted to connect the best of the constructivist approach to the use of computers--the cardiovascular toolkit--with the best of the tutorial--the intelligent tutor. The toolkit (programmed in Allegro Common Lisp on MacIntosh computers) allows students to construct a cardiovascular system graphically by hooking together appropriate parts. The tutor was designed to guide and critique student work. Students start by selecting cardiovascular components (hearts, vessels, capillaries) as graphic objects from a menu of icons.

Gauges capable of measuring blood pressure, flow, volume and oxygen can be attached to the components to visualize the system's status. Components and gauges can be moved around and hooked together to build new structures. Parameters for each component, such as resistance to flow or pumping rate, can be easily modified to create changes in cardiovascular behavior.

Thus, by selecting and placing graphic objects on the computer screen, the components can be connected in a number of topological ways. The user can then run the system by clicking on a control panel, and can, if he or she chooses, accelerate or animate heart beats, blood flow and one-way valve operation. Graphing windows associated with gauges immediately display factors such as pressure, flow, and oxygen content.

The curriculum built around the tutor is designed for two-hour lab periods, supported by lecture and pre- and post-lab discussion sessions. It first acquaints students with model behavior and instructs them on how to pose problems and design experiments. In later laboratories, students devise their own hypotheses, design their own experiments, and practice drawing conclusions based on results. The software tutor helps instructors coach or critique students as they are making constructions.

Evaluation

Student and instructor curricular materials were tested in small groups, using four experiments on the cardiovascular system. A second lab evaluation tested students' ability to generate hypotheses and draw logical conclusions. A third tested students' skill at maximizing the performance of a construction for producing, transporting, and consuming oxygen.

Project staff used videotapes of pairs of students using the lab instructions and simulations to assess the adequacy of the software interface, the instructional design, and prior student knowledge, abilities and misconceptions. Extensive testing during lab experiments identified key problems in both the students' biological understandings and in the human-machine interface. The students' misconceptions turned out to be deeply held and related to basic principles of physics. Fortunately, the videotapes showed that the software helped eliminate the misconceptions, as students discovered for themselves the flaws in their logic and in their assumptions. Both the videotapes and classroom testing showed that students and faculty using the software found it instructive and easy to use. In fact, most students learned to use the program without the manual.

The Construction Kit and curriculum were distributed to 18 additional sites for field testing (universities, colleges, community colleges and schools) as part of the testing of BioQuest software (Quality Undergraduate Educational Simulations and Tools in Biology, Beloit College). Although BioQuest requested evaluations of the software from all of its test sites, especially on student use and learning, only a few sites responded. Most comments from field sites were related to problems in the software (especially regarding compatibility problems with various versions of the MacIntosh system).

Project Impact

The Construction Kit and curriculum are being used by over 500 students each year in at least four different biology courses at the University of Oregon. The software has become part of a larger curricular project (funded by FIPSE and the National Science Foundation) designed to encourage investigative learning in biology courses for non-majors.

Unanticipated Problems

Developing causal explanations for the behavior of arbitrary constructions proved to be more complex for the faculty than anticipated. Also, students' false expectations confounded interpretation of test data. Definitional problems arose out of the testing of "normal" versus "abnormal" physical properties and of absolute versus relative measurement of these properties.

Although significant progress was made in developing the intelligent tutor, it proved unrealistic to incorporate the tutoring software into the final software product within the time-frame of the project.

Major Insights and Lessons Learned

Faculty often had difficulty pinpointing the nature of student problems simply from observing students using the software. When a student felt the simulation had behaved unexpectedly, for example, there were at least four possible explanations: 1) the student did not under- stand how the simulated system represented the real systems being simulated (a problem with the interface); 2) the simulated system did not accurately represent the real system (a problem with the simula- tion model itself); 3) the student had misconceptions about the real system, and/or 4) the student was misinterpreting the results.

The first two explanations complicate the use of simulations in education and underscore the need for thorough testing of both the user interface and the simulation model. If a simulation is to erase student misconceptions about real biological systems, then both students and instructors must have confidence that what they are seeing in the simulation accurately reflects what happens in real life.

Otherwise, it is not possible to know whether to focus on the student or on the software when something unexpected happens. These problems were especially acute for this software because of its ability to design systems of arbitrary complexity, challenging even expert faculty to know what to expect.

Generally, designing and building effective educational software is very difficult, time-consuming and expensive. Testing the pedagogical goals of the software while it is being developed and while it is in use is essential, but very little software is subjected to this kind of review.

Project Continuation

The software is used in several University of Oregon biology courses. Testing at the 18 sites continues; therefore, neither the software nor the curricular materials are quite ready for final publication. When FIPSE support ended, the University, Apple Computer, and BioQUEST funded the last stages of the project. The software will be published on CD-ROM with other BioQUEST materials in 1993 by the University of Maryland Press.

One of the project directors, the Chair of the Biology Department, was awarded a second FIPSE grant of $257,000 to support workshop biology for non-majors. This project, which promotes scientific literacy through investigative labs and issue-oriented activities, was influenced by the student-directed and open-ended investigations of the Construction Kit. Recently, the toolkit has been modified to be more useful in a workshop format.

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Available Information

Beta versions of the software (the Cardiovascular Construction Kit) and the lab and users' manuals are available from the project directors:

Daniel Udovic
Department of Biology
University of Oregon-POB 3158
Eugene, OR 97403
503-346-6051

Nils Peterson
From the Heart Software
Eugene, OR 97403

Sarah A. Douglas
Department of Computer and
Information Science
University of Oregon
Eugene, OR 97403
503-346-3974

The software runs on MacIntosh computers. It requires a hard disk and at least four megabytes of memory. Please send two empty 800-kilobyte or high-density diskettes. In return, the project directors ask for help in evaluating the software and curricular materials at additional campus sites.

The Intelligent Tutor is also available, as is a 17-minute videotape of the toolkit in use.

The software and manuals are also being distributed as part of the BioQUEST project. BioQuest simulations are published on CD-ROM by the University of Maryland Press. For information about BioQUEST, write to:

John Jungck
Project BioQUEST
Beloit College
Beloit, WI
608-363-2743

Several articles based on the project include:

Douglas, S., Peterson, N.S., and Udovic, D. "The Cardiovascular Construction Kit" in BioQUEST: Quality Undergraduate Educational Simulations and Tools, University of Maryland Press. 1993.

Douglas, S.A. and Zheng-Yang Liu. "Generating Causal Explanation from a Cardiovascular Simulation" in Proceedings of the International Joint Conference on Artificial Intelligence, Detroit, MI. August 1989.

Downing, Keith Linn. 1990. The Use of Teleology in the Qualitative Evaluation and Explanation of Circulatory Systems. Ph.D. Dissertation. University of Oregon. (Available through University Microfilms.)

Novak, David. "A Laboratory Curriculum for the Cardiovascular Toolkit". Thesis submitted in partial completion of the Master's Degree, University of Oregon, Summer 1989.

UNIVERSITY OF RHODE ISLAND

Chem-Tutor: An Expert System For Teaching Freshman Chemistry

Purpose

After a freshman chemistry course, most students are able to use the information they have acquired to solve simple, carefully-structured problems. When confronted with an exercise that requires them to use more than one principle, or that does not explicitly state necessary relationships, however, students are likely to falter and give up without even attempting to think their way through the problem.

Research indicates that success in solving complex problems is highly correlated with hours of practice--thousands of hours of practice--and with appropriate feedback. Yet often introductory science classes number in the hundreds of students, and teaching assistants typically teach three laboratory sections per semester. Thus, neither faculty nor teaching assistants are able to provide students the amount of practice and feedback they require to learn to solve complex problems. This project addressed that situation through the design, writing and testing of software for an intelligent computer-assisted instructional system, Chem-Tutor, that enables first-year chemistry students to improve their ability to solve complex problems.

Innovative Features

Chem-Tutor integrates an intelligent tutoring system into a traditional academic setting. It improves the complex problem solving ability of the student by articulating its own reasoning skills and explanations, coaching the student's problem solving behavior directly, and diagnosing his or her errors.

Chem-Tutor consists of a domain expert, which contains a knowledge base that serves as a model for problem solving concepts and procedures, and a problem manager, which controls a library of over 1,200 problem templates. It also includes a tutor expert, which comprises the rules and procedures for interaction with the student, and the user environment--on-line tools such as a full-screen Periodic Table of the Elements. The program runs on a DEC VAX computer, contains over 50,000 lines of Common Lisp code, and is designed to be used at least one hour a week over an entire semester.

In the course of the project, a separate, complementary program, Chem-Tutor Instructor Expert, was also developed. This tool allows the instructor to reorganize, add, or delete areas of Chem-Tutor, to generate reports on the status of individual students or of the entire class, and to intervene when Chem-Tutor indicates that a student is in difficulty.

Evaluation

Approximately 600 students in The University of Rhode Island's beginning chemistry classes rated their satisfaction with Chem-Tutor 6.8 on a scale from 0 (poor) to 10 (excellent). There was a large amount of variation from the average, and this variation correlates with the quality of the student's relationship with the teaching assistant.

After using Chem-Tutor, student performance on the final exam in the fall 1988 semester was compared to the final exam grade distribution for the fall of 1986, before Chem-Tutor was introduced. A check of the SAT scores for these two classes separated by three years shows no significant difference, and the sections were taught by the same instructor at the same time. One can therefore assume that the

1986 and 1988 students were equivalent in background, ability, and SAT scores. The mean exam score for 1986 was 52.6%, and the mean exam score for 1988 was 56.6%. This is almost a 10% change in the average grade. Using a t-test, the comparison revealed a significant difference between students who had used Chem-Tutor and those students who had not ($t(683)=2.79$, $p<0.01$).

Surprisingly, despite the availability of Chem-Tutor the percentage of completed homework assignments per student was as low as 63.5%. Nevertheless, final grades did correlate positively with the percentage of homework completed--that is, students who completed more homework received higher final grades.

Project Impact

Chem-Tutor has been used by over 4,000 URI students to solve some half million chemistry problems. The required use of Chem-Tutor has increased the time that students spend solving problems, and the time spent tutoring on the part of instructors has decreased proportionately. The project has been institutionalized at the University of Rhode Island since 1989.

Several other institutions, including the University of Wisconsin, SUNY Albany, the University of New Hampshire, and Milan Polytechnic University have purchased Chem-Tutor and are adapting it to their own needs.

Unanticipated Problems

In the course of the project, efforts to develop a natural language user interface had to be abandoned due to the complexity of natural

language processing. The designers of Chem-Tutor are attempting to overcome the system's limited ability to use artificial intelligence.

Because Chem-Tutor is text-based and keyboard-driven, its usefulness in certain areas requiring use of graphics is insufficient. Future systems will operate in a Graphical User Interface environment.

Major Insights and Lessons Learned

As a result of experience gained in the development and use of Chem-Tutor, it has become apparent that any successful tutoring system must take into account the four elements that make up an integrated learning environment--the discipline, the available technological resources, the instructor, and the learner--and their interactions with each other.

Project Continuation

An analogous program, Math-Tutor, was created after Chem-Tutor, with support from the Rhode Island Board of Governors for Higher Education Fund for Excellence. A new FIPSE grant funded the development of ChemScholar and MathScholar, two PC-based programs with a more powerful and sophisticated graphical user interface. These programs will actively engage the student in the direct manipulation of scientific objects, concepts, and problem-solving processes. FIPSE is also supporting a project entitled Students Learning and Teachers Working Using Networked Computer Techlogy.

Available Information

The Chem-Tutor software system for VAX/VMS, including the Instructor Expert program, is available for $595. User guides may be purchased separately for a nominal fee. Address requests to:

James L. Fasching
Department of Chemistry
Pastore Laboratory
University of Rhode Island
Kingston, RI 02881
401-792-2298

GENERAL EDUCATION

Two or three years ago, this category would surely have included more projects. The particular three years covered by this volume represent a trough between two waves of change in general education. In the mid-eighties, many campuses restored structured general education programs that had been eliminated or attenuated by reforms of the early 1970's. After a brief lessening of interest in general education, the matter has returned to the forefront of higher education concern as institutions make programs more multicultural, internationalize the curriculum and develop specific courses required of all students. These projects are just now being completed and reporting their results.

The number of general education projects featured here is further constrained by the difficulty of evaluating the results of such programs. The evaluation methodology is not sufficiently developed, nor are the effects of general education curricula, other than skills courses like English composition, readily discernible in the short run.

The two projects described below represent quite different aspects of general education. Proceeding from a desire to reduce the fragmentation of learning inherent in a curriculum organized in terms of distribution requirements, the University of North Texas has introduced as an option a highly structured course focused on classic texts of Western civilization. SUNY/Buffalo's program attacks the problem of developing students' general intellectual skills through a freshman/sophomore level course in "Methods of Inquiry."

UNIVERSITY OF NORTH TEXAS

The Classic Learning Core

Purpose

The Classic Learning Core (CLC) was developed to overcome the fragmentation of learning characteristic of the distribution requirements that make up general education curricula. The program consists of a set of 21 courses, of which students must choose 17, offered in nine departments.

Students must take the courses in a set order, beginning in the freshman year and extending through the junior year. A capstone course in the senior year rounds off the program. Freshmen take English composition and a foreign language and choose among world history, classical argument (rhetoric) and art appreciation. Sophomores take world literature, political science, American history and foreign language. Juniors take ethics and psychology.

The courses are linked by a theme reflecting the classic values of "virtue, civility and reason." Faculty meet monthly and for two weeks during the summer to coordinate syllabi and reading lists so that courses can make use of readings and ideas that students have worked with or are currently studying in other CLC courses. Faculty incorporate these linkages not only in classroom discussion but in writing assignments and examinations.

Approximately 400 students each year elect the Classic Learning Core, of whom perhaps two-thirds persist to completion. Students who drop out of the Core but remain at the University lose no time,

since all CLC courses satisfy requirements in the regular general education program.

Innovative Features

The innovation lies in the linkages. The courses are linked not only thematically but through the design of syllabi, choice of texts and individual items of course content as well. The continuing cross-referencing from course to course and the classical humanistic approach to course content provide the pedagogical links.

Students enjoy the advantages of small classes with a minimum of lecturing and a maximum of discussion. Insofar as possible students are assigned complete primary texts to read.

Beyond the day-to-day activities of the classroom, students and faculty are engaged in common intellectual pursuits. Faculty share teaching objectives, and students in the CLC have extended the relationship that began in the classroom to publication of a newsletter, fund-raising activities and group summer study abroad.

Evaluation

The program received formal qualitative evaluations from two scholars external to the University, one from within the state of Texas, one from outside. They studied curricular materials, sat in on classes and interviewed students and faculty. In addition, a member of the University faculty conducted an evaluation based on questionnaire responses of students and faculty involved in the program. In general, evaluations indicate an encouraging degree of satisfaction with the program on the part of all groups involved and regardless of the form of evaluation.

Project Impact

The CLC has provided a point of focus, both academic and social, for participating students. It has many of the qualities of a college within a much larger university. Faculty who participate regularly in the program report a renewal of energy and intellectual enthusiasm, much of it resulting from the cross-disciplinary interactions and regular association with colleagues in a common pedagogical enterprise.

The CLC has inspired two additional programs. The Classic Combination Master of Business Administration Program combines the CLC requirements, a liberal arts major, a minor in business and a fifth-year master's degree program in business leading to an MBA. The Texas Academy of Math and Science permits early college entry for students proficient in math and science. All students admitted under this program must complete the CLC requirements.

Unanticipated Problems

Program designers and University administrators had originally hoped that the Classic Learning Core would enroll a larger number of students, perhaps becoming a required part of the general education program for all UNT students. The expense of the program, involving as it does small classes and substantial numbers of senior faculty, has not permitted expansion beyond the current 400 students per year. Furthermore, the number of program drop-outs suggests that the CLC would encounter resistance from a substantial number of students were it to become a uniform requirement.

As to the program itself, evaluators noted the need for clearer and more frequent connections among courses. This observation has led to

more deliberate efforts to take advantage of the thematic and curricular coherence of course and program design.

An advising program under which each CLC student is assigned a faculty mentor has not worked as planned, largely because so few students take advantage of the opportunities presented.

Major Insights and Lessons Learned

The project has demonstrated that a large regional university can find faculty interested in expending the physical and intellectual energy necessary to offering and sustaining an integrated program of humanistic studies and enough students interested in pursuing it to justify and reward the effort. Such a program is not, however, likely to be suitable for all students or implementable institution-wide because of costs and demand on senior faculty teaching time.

Recognition

Articles on the Classic Learning Core have appeared in several newspapers, including the Chronicle of Higher Education. It has received widely-noted favorable mention by both former Secretary of Education William Bennett and former Director of the National Endowment for the Humanities, Lynne Cheney.

Project Continuation

University of North Texas administrators have been highly supportive of the program since its inception. The CLC is now established as a separate unit, fully supported by University funds. An endowment has been established and $2 million of a $35 million capital campaign have been earmarked to enhance the endowment.

Available Information

Brochures, course syllabi and a student guide to the CLC are available by writing to:

L. Robert Stevens
Classic Learning Core
P.O. Box 13827
University of North Texas
Denton, TX 76203-5187
817-565-4672

or

J. Don Vann
Director of Academic Core Programs
P.O. Box 5187
University of North Texas
Denton, TX 76203-5187
817-565-4030

STATE UNIVERSITY OF NEW YORK AT BUFFALO

Critical Inquiry Studies for the General Undergraduate Population

Purpose

The project grew from a recognition by many administrators and senior faculty that a large number of entering students, though successful in their pre-college studies, lack the learning skills necessary for success at the college level. Specifically, students have not developed the ability to ask questions of a lecture, discussion, or text, to approach each analytically and in the particular conceptual modes that the discipline they are studying requires. They are accustomed to memorizing facts, rather than using them to develop conceptual understanding and to support a series of arguments or claims.

To address this familiar problem, the project director developed a three-credit elective course entitled "Methods of Inquiry" (MOI). MOI helps students to learn: 1) strategies for identifying questions critical to the discipline they are studying; 2) different methods for mapping course information; 3) principles for monitoring comprehension and guiding the effective management of tasks (as opposed to time management), and 4) ways of formulating hypothetical options as a basis for reasoned judgment.

Innovative Features

Using as a springboard materials developed for at-risk students by Marcia Heiman and Joshua Solomianko, the developers of MOI designed a course for individuals at all levels of ability. The course

differs from the more familiar small section courses intended to help students adjust to the university environment in that it is entirely academic in its orientation and is usually offered in sections of 100 or more. Thus in its first eight semesters the course enrolled a total of 2,900 students, filling every seat available.

Despite the size of the sections, all students receive weekly one-on-one assistance in applying MOI strategies to their learning. Lecture sections, which meet twice a week, are each supported by a graduate teaching assistant and a corps of peer monitors--academically successful, former MOI upperclass students trained to serve in this role. Monitors, under the supervision of the project director and the teaching assistant for the section, meet weekly for 30-45 minutes with each student to see how he or she is applying skills covered in the lectures and to provide assistance. The academic and personal growth of the monitors themselves is a significant by-product of the activity.

Methods of Inquiry is organized as an independent program under the aegis of the Vice Provost for Undergraduate Education. Three faculty from different disciplines work with the program each semester, along with five teaching assistants and approximately 27 undergraduate monitors.

Evaluation

The project director and her assistants amassed detailed data on the results of the first eight semesters of the course (N=2,900 students). They kept track of improvement in grade-point averages and retention figures as well as student-reported information about study practices, attitudes toward learning and regard for the course. These data are reported by prior grade-point average, size of class

(some small sections were offered), major area of study, ethnic group and gender.

Some major findings include:

o More than 63% of students improved their GPA's, including 84% of those with GPA's less than 1.99. The latter group improved by an average 1.10.

o The number of students with GPA's of 3.69 or higher doubled.

o A grade of A in MOI had a high positive correlation with a high overall GPA (not including the MOI grade) for the semester in which students were enrolled in MOI.

o Of the undergraduates, MOI students surpassed the overall University rate of retention by 11% or more in every admissions cohort.

o Students reported that their concern for good academic performance had increased.

o Students reported that they studied longer outside of class and had higher estimations of their own academic strength.

o Students heavily enrolled in math/science courses are significantly less likely to improve GPA's than those enrolled predominantly in social sciences and humanities (51% vs. 67%). Few statistically significant differences were noted among other sub-groups.

Project Impact

"Methods of Inquiry" has become fully institutionalized, enrolling about 350 students each semester. Faculty reception of the course has been positive. In addition to those who have been directly involved in instruction, several faculty have developed discipline-specific materials for the course. Related workshops offered by the Office of Teaching Effectiveness have led faculty members to use Methods of Inquiry materials in their own courses. In particular, the SUNY/Buffalo Dental and Medical Schools and College of Engineering have all adopted programs based on the MOI materials to serve various segments of their populations.

Faculty and administrators from approximately 200 institutions have requested and received information about the course.

Unanticipated Problems

Efforts to involve faculty in two-day training sessions providing hands-on experience with course materials have not proven successful. Responsiveness to shorter sessions and discipline-related sessions, however, has been excellent. (120 faculty attended the last two-hour workshop.)

The considerable difference in results for students in math/science and humanities/social science programs has persisted, with math/science students remaining less likely to apply the strategies for critical thinking and discipline mastery taught in the course.

Although student response to the course is positive (72% would recommend it to a friend), a consistent 13% have a negative response.

This group is not demographically distinguishable from those who respond positively.

Major Insights and Lessons Learned

The project demonstrates the possibility of engaging substantial numbers of students in large, heterogeneous classes in improving their thinking and learning processes. Considerable success appears to be attainable by students from diverse backgrounds and achievement levels.

One key to success may be to approach the critical thinking process in a non-adversarial way, with an emphasis on learning as a means for achieving understanding. This approach encourages independent thought and conceptualization.

Considerable faculty support can be generated for this sort of activity as long as it has clear academic substance. Many faculty are willing to include in their courses units that teach awareness of critical thinking.

The program would appear to be adaptable to many kinds of institutions, but smaller ones may have difficulty with the kind of complex organization demanded by the project and may find a discipline-related approach more viable.

Project Continuation

The Methods of Inquiry Program has been fully funded by the University. It serves approximately 700 students a year.

Available Information

The project director welcomes telephone inquiries and will make available a comprehensive summary of data collection instruments, data and working papers.

Susan R. Schapiro, Director
Methods of Inquiry Program
Ellicott Complex
SUNY at Buffalo
Buffalo, NY 14261-0012
716-645-3448

TEACHER EDUCATION

Responding to a wave of national attention to teacher training sparked by the Holmes Group and the National Center on Education and the Economy (formerly the Carnegie Forum), FIPSE provided funding in the late 1980's for some 45 projects in teacher education. These projects had such purposes as recruiting minorities and new populations to the field, recruiting more academically able and broadly prepared people to teaching, and strengthening the subject content of pre-service preparation.

While many of FIPSE's projects have been well implemented, demonstration of their success in preparing teachers more effectively has proven elusive. Given the fact that by the end of a three-year funding period the first graduates of an improved program are just entering the first year of teaching, this inconclusiveness is to be expected. The Union College program described below is in this respect no exception, but it is an unusually innovative and flexible program whose progress is exceptionally well documented. The Northern Virginia Community College program to train single mothers as certified child care providers demonstrates the effectiveness of education in alleviating problems of poverty in the community.

On the other hand, some innovations funded by FIPSE simply did not work, though not for lack of care and effort by the institutions that undertook them. For example, a set of projects that attempted to address the projected teacher shortage by recruiting early retirees (e.g., from the military services) and career changers to teaching were unable to find the numbers of interested people they thought they could. A large percentage of those recruited did not finish the program.

Other kinds of projects were more susceptible to early demonstrations of success. The "PreTeacher Assessment Program" developed at Indiana University of Pennsylvania has shown a high level of correlation between assessor ratings of pre-service teachers in simulated situations and expert judgments of these student teachers' pedagogical skills demonstrated in actual classroom settings.

INDIANA UNIVERSITY OF PENNSYLVANIA

The PreTeacher Assessment Center

Purpose

During World War II, Dr. Henry Murray, a Harvard psychologist, was asked by the Office of Strategic Services to develop a way of determining the aptitudes of potential spies for the Allies. Murray and a team of psychologists first identified the skills and characteristics that were required of espionage agents, such as problem analysis, initiative, tenacity, and stress tolerance. Then they tried to match these abilities as closely as possible with simulated activities that would trigger a demonstration of the kind of behavior required by espionage work. The operation was a success--the Allies lost fewer agents behind enemy lines, and the quality of the information gathered by these agents improved.

In the post-war years, Murray's ideas were applied to management, and in the 1970's, to school administration (the Principal Assessment Center). When Indiana University of Pennsylvania, Millersville University, Slippery Rock University and Development Dimensions International joined together to form the PreTeacher Assessment Center, they too followed the approach first developed by Murray and his team.

To assess the abilities of future teachers, the Center first identified thirteen basic teaching traits and skills: planning and organization, monitoring, leadership, sensitivity, problem analysis, strategic decision making, tactical decision making, oral communication, oral presentation, written communication, innovativeness, tolerance for stress, and

initiative. The staff then designed four simulations that enable students to demonstrate these skills as they solve problems and carry out tasks.

Based on the writings of teachers and faculty at all instructional levels, two of the simulations focus on classroom situations (students are asked to react to classroom scenes on a videotape and write a lesson plan) while the other two simulations assess generic traits such as initiative, sensitivity and decision making. The content validity of the four assessment simulations was established by three panels of teachers, faculty and administrators, whose comments and suggestions were incorporated into the simulations.

The Center also developed some assessor training manuals and teacher training modules. Each of the latter consists of a videotape that models good teaching and a set of assignments that allow the students to practice correct behaviors. The topics of the modules are: Beliefs About Teaching, The Sensitive Teacher, The Teacher Leader, The Innovative Teacher, and Planning and Organizing.

Evaluation

To determine how well the Center's assessment of students predicts their teaching behavior, Center staff assessed five students during the first week of their student teaching experience. Then the student's university supervisor observed the student's teaching, using clinical supervisory techniques. The final rating of the student for six of the thirteen teaching skills was based on a number of classroom observations, on responses to a series of statements designed to make students reflect on their teaching, and on the students' journals, lesson plans, and other materials.

There was remarkable agreement between the Center's assessment and the ratings by the university supervisors. On 93% of the occasions, on-site observations were within a one-point range (on a scale of 1 to 5) of the assessment results. The researchers concluded that the Center's assessment scores accurately predict on-the-job performance in six skill categories.

Project Impact

The PreTeacher Assessment Center has become self-supporting, and is being used by Indiana University of Pennsylvania and Slippery Rock University. Between 1987 and 1990 the Center trained 120 assessors and assessed 200 students. The Center receives frequent requests for information and training from schools and postsecondary institutions.

Major Insights and Lessons Learned

The Center has assessed students majoring in elementary, secondary, and special education. The major does not seem to affect assessment results, probably because the simulations focus on pedagogical skills rather than on knowledge of a certain subject (the training modules strongly emphasize the importance of content knowledge).

In general, students' scores indicated little skill in leadership, initiative and innovativeness. Scores in sensitivity, oral presentation, problem analysis and decision making were judged barely adequate. Students obtained higher scores in written communication, tolerance for stress, and oral communication. However, although their oral skills were adequate, their presentations lacked enthusiasm and logical structure.

Project Continuation

The Center is supporting itself and continues to expand. In 1991-92, 100 sophomores were assessed. Carlow College, which has established its own assessment center, trained 25 assessors, and requires all education majors to undergo assessment. The Pittsburgh public schools are currently piloting the Center's training films, and other institutions are considering forming a similar center on their campus.

Recognition

The PreTeacher Assessment Center received the 1989 Christa McAuliffe Showcase for Excellence Award.

Available Information

Copies of articles about the Center, training tapes and other materials may be obtained from:

Robert E. Millward
Assessment Center
Indiana University of Pennsylvania
136 Stouffer Hall
Indiana, PA 15705-1087
412-357-5593

NORTHERN VIRGINIA COMMUNITY COLLEGE

Child Care Certification for Teen Single Mothers

Purpose

The nation is witnessing dramatic increases in early maternity. The city of Alexandria has the third highest incidence of teen pregnancy in Virginia. Northern Virginia Community College, the Alexandria Public Schools and the Alexandria community joined together in a program to provide college certificates to young single mothers, hoping to break the cycle of poverty through education and employable skills. The project's goal was to enable these mothers to join the pool of qualified child care professionals in the region through a program of study in child development.

Innovative Features

While the early maternity population is large, few postsecondary programs target this group, despite city and college support services. In this project Pell Grants were the major source of tuition funding, and the city granted transportation, housing, day care and food subsidy assistance. Students selected for the program were 17 years or older, high school graduates with only one child and free of any drug dependency or criminal record. By qualifying these young mothers as child care professionals, project staff hoped that their economic self-sufficiency and child care needs would be resolved simultaneously at the work place.

Additional community organizations joined in support of the program:

o Alexandria's Mayor, City Manager, and the Director of Social Services joined College, community, and public school administrators served on the program's advisory committee;

o Arlington County provided tuition funding;

o the Winkler Foundation funded an apartment unit, furnished by community contributions, for several participants;

o Perpetual Bank opened savings accounts for each student, and assisted them in budget management;

o local physicians provided hygiene and free medical treatment;

o Alexandria Public Schools guaranteed employment to all students completing the certificate program as instructional aides;

o 15 of the 23 Virginia community colleges, several community colleges from Maryland and Pennsylvania, and 10 four-year colleges supported the program's dissemination conference; and,

o program staff noted an increase in college enrollment by parents, relatives, and siblings of participating students.

Evaluation

Over the three-year period, 138 potential participants were interviewed. Of the 55 that enrolled in the program, 40 are now

employed and meet the Virginia certification standard to work full time as instructional aides in child care settings. The remaining 15 are currently enrolled at the College in the Associate Degree Program. Significantly, students who remained in the program had no second pregnancies, and none went on public assistance, other than Section Eight Housing. The program is now attracting the sisters of the successful participants.

Unanticipated Problems

Student retention was the overriding problem faced by the program. Even with comprehensive academic and social services, personal, health, and financial difficulties caused a few students to drop out when the program first started. Second pregnancies were not an obstacle, however, nor were academic inadequacies.

These impoverished young mothers needed to earn money in the time they were devoting to schoolwork, and they did not see how they would earn enough income working as child care professionals. Thus, project staff found it necessary to broaden academic choices and transfer options for the students. Nevertheless, education alone could not overcome the numerous problems faced by these single parents.

Project Continuation

The program remains a cooperative venture between the College, the city, the school system and the Alexandria community. The College continues funding faculty and staff salaries associated with the project. When the FIPSE grant ended, the city of Alexandria continued support of the staff through January 1991. The City Council supported a plan to fund non-teaching personnel for the 1991-1992 academic year. Arlington County continues to pay tuition for

participants, while the city provides free day care for their children.

The partnership agreement between the College, the city, the school system, and the community was the essential ingredient for the program's success. It became increasingly clear that the students faced multiple life problems that required multiple social services beyond those the College could provide.

Recognition

The project received statewide attention, as did the project director herself. The project had television coverage nationally (CBS's "Forty Hours"); on public television (WETA); on Washington, D.C. television ("Capitol Edition"); and on local public television in Virginia. For her innovative work the project director won the Washingtonian of the Year Award, the Urban League Award, the Boy's Club Award, the Hopkins House Award, was described in Jet Magazine, and featured on the front cover of Old Dominion Magazine.

Available Information

Northern Virginia Community College will make available copies of the final report and project handouts. The project director had volunteered to visit campuses and speak about the program.

Requests should be addressed to:

Eula M. Miller
Education Program Head
Northern Virginia Community College
Alexandria, VA
703-845-6224

UNION COLLEGE

Introducing Teacher Education to a Liberal Arts Campus: A Model for Integration with the Disciplines

Purpose

Pre-professional programs at liberal arts colleges are frequently viewed as marginal to the institution's mission. This is especially true of teacher education programs, which seem to attract more than their share of suspicion and even outright hostility on the part of liberal arts faculty.

When Union College faculty and administrators set about planning the Educational Studies program, the need to integrate it into the liberal arts curriculum and to allay faculty apprehensions about "creeping pre-professionalism" was paramount in their minds. The resulting model of teacher education for a liberal arts campus endeavored to attract high ability students to teaching; to integrate the study of pedagogy into the liberal arts curriculum; to involve both faculty and secondary teachers in the design and teaching of the program; and to operate in a cost efficient manner.

Innovative Features

From the beginning, project planners decided not to create a small Education Department that would quickly become isolated in Union College's staunchly liberal arts campus. Instead, faculty from English, languages, mathematics, sciences and social sciences teamed up with secondary school teachers to create the Curriculum and Methods

courses for these areas. The remainder of the faculty were asked to review their departmental curricula from the perspective of teacher preparation. They responded by enhancing the scope, rigor and coherence of the major, modifying requirements, eliminating gaps, and setting guidelines for acceptance into the Educational Studies program. (Before a student can be admitted to the program, he or she must obtain a departmental recommendation.)

To further ensure faculty commitment, individuals teaching Educational Studies were given a certain amount of discretion in the calculation of their teaching loads, and published articles related to pedagogy within a discipline were included in tenure and merit reviews. In an effort to raise the consciousness of the entire community regarding the importance of pedagogy, the College invited outside consultants and held special colloquia entitled "The Science And Art Of Teaching." The work of the individual departments is coordinated by a Director of Educational Studies, who holds a 12-month faculty appointment, performs some administrative duties, and reports directly to the Dean of the Faculty.

The project developed three options: an undergraduate program combining education courses with a regular academic major and yielding a BS/BA plus certification; a one-year graduate program leading to an M.A.T. degree and certification; and a combined-degree program consisting of five years of study and yielding a BS/BA, an M.A.T. and certification. The graduate curricula include a full-year, half-day teaching internship.

Educational Studies receives institutional funds through the regular academic budget and tuition income from the Office of Graduate and Continuing Studies. Thus, the College is able to offer the M.A.T. at low cost and to waive some tuition for undergraduates.

Evaluation

Efforts included collection of admissions data, pre- and post-surveys, portfolios, and interviews with faculty and teachers as well as with students at various points in their curricula and in their first year of teaching.

Although it is too early to judge the quality or retention rates of the new teachers, it has already become apparent that the program has succeeded in attracting liberal arts students of high caliber to teaching. In addition, unlike most education programs, which are made up of a majority of humanities majors, Union's Educational Studies obtains roughly half of its students from science and mathmatics.

As beginning teachers, Union College graduates feel confident and well prepared, and are less concerned with salary than with taking on new responsibilities, becoming leaders in the schools, and continuing to develop professionally.

Project Impact

Not only did the faculty who were directly involved in the curriculum development teams find the experience professionally stimulating, but their colleagues in departments across the campus became aware of the paramount importance of proper pedagogy. As faculty collaborated with high school teachers, they developed a new regard for these colleagues and a commitment to encourage outstanding students to join and consider teaching as a profession.

Unanticipated Problems

Although the extensive involvement of liberal arts faculty constitutes the program's main strength, it also implies a number of problems, mainly related to faculty reluctance to engage in team teaching with high school teachers during the summers and to offer discipline-based courses for the M.A.T.

Turning teachers into mentors for Union student interns has also brought its share of problems. Without special funding, most mentors have no incentive to attend summer training sessions, and even with the benefit of training, not all mentors are able to work adequately with their interns.

Initially, it was expected that school districts would pay their interns. That has proved unworkable, due to objections from teacher unions, budget difficulties, and an ample supply of teachers in the area. However, interns do receive substitute wages when the mentor is absent.

Major Insights and Lessons Learned

This project has demonstrated the wisdom of involving liberal arts departments in the development and instruction of teacher education curricula, as opposed to segregating the study of pedagogy in a small enclave of its own. Involvement of faculty across the board has also ensured that the program will remain an integral part of the College, as proven by its having already survived a number of significant personnel changes.

Bringing together faculty and teachers to develop the curriculum was an unquestionable strength of the project: it not only made faculty

appreciative of their colleagues in the schools but fostered discussion of pedagogy and committed the College to collaboration with the schools, in efforts such as developing a comprehensive program for at-risk students with the Schenectady City Schools.

Recognition

The project has been featured at the conference of New York's Confederated Organizations of Teacher Education, and showcased by the New York State Education Department in statewide meetings of teacher education schools. Project personnel have made presentations and served as consultants with a number of organizations and institutions.

Project Continuation

All aspects of the project--budget, faculty and administration--have been fully institutionalized.

Available Information

Program descriptions and other materials are available from:

Joan M. Krejci
U.S. Department of Education
Fund for the Improvement of
Postsecondary Education
7th & D Streets, SW Room 3100
Washington, DC 20202-5175
202-708-5750

ETHICS

Public concern about the failure of colleges and universities to develop a strong sense of ethical behavior in their graduates dates from the Watergate era. It has only been strengthened over the years by a series of major scandals involving people whose higher education, the public feels, should have provided them with a stronger ethical rudder. While higher education recognizes the limitations of instruction in ethics in channeling behavior, many programs, particularly professional ones, have responded seriously to the public concern.

The St. Cloud State program is a fine example, because of both its disciplinary breadth and its use of practicing professionals in the classroom. While the ultimate test of such a program, the lifelong attitudes and behaviors of the students who have completed the courses, can probably never be measured, changes in attitude and understanding between the beginning and the end of the course are firmly established.

The quality of ethical judgements in medical treatment has received similar public attention and led to the mandatory establishment of hospital ethics committees in most states. Higher education has an important role to play in training committee members in ethical thinking, a challenge that has been taken up successfully at the national level by humanities faculty at the University of Connecticut Medical School.

Both of these projects exemplify a new interest and willingness among philosophers to help people learn to deal thoughtfully with the practical problems of acting ethically.

UNIVERSITY OF CONNECTICUT

Improving Hospital Ethics Committees (HECs): Educating Across the Health Professions

Purpose

Concern that further expansion of the scope and complexity of modern medicine might soon overwhelm decision making about patients has led to the widespread introduction of Hospital Ethics Committees (HECs). The membership of such committees is generally made up of doctors, nurses, lawyers, hospital administrators, risk managers, social workers, philosophers, and clergy, with the medical professionals predominating. While the members of these committees are on the whole well equipped to understand the technological issues associated with complex treatment decisions, few have had any training in moral philosophy (ethics), health law, or associated disciplines. This project had as its goal the development, piloting and evaluation of a week-long ethics and health law curriculum for members of HECs.

Project Activities

The curriculum focused on three areas of concern to HECs: committee structure and procedures, techniques for case analysis, and topical issues. Three sessions were devoted to committee mandate, authority and operating practices; six to relevant moral, ethical and legal issues and their application; and six to illustrations of their application in particular matters that commonly come to HEC attention. Ultimately these 15 core sessions were merged into an intensive one-week seminar that also included attention to sources of literature relevant to core issues and the means of assessing them.

The seminar was offered three times between April, 1988 and February, 1989 in different parts of the country to groups of about 15 each, a total of 47 in all. One seminar included only new HEC members; another, members with one to three years' experience; and the third, veteran members. Each seminar group was representative of the mix of professional backgrounds typical of HECs. All three seminars were taught by the co-project directors, project faculty, and legal preceptors recruited locally.

Innovative Features

This is the only program to offer systematic training in bioethical and legal issues to HEC members. Given that nearly two-thirds of the nation's acute care hospitals have appointed healthcare ethics committees, this sort of training is of utmost importance to large numbers of people.

The project directors have further initiated a periodical, Hospital Ethics Committee Forum, (now HealthCare Ethics Committee Forum) which appears six times a year. HEC Forum displays the work of HEC members and includes HEC members on its editorial advisory board.

Evaluation

Separation of the original 47 participants into seminars based on level of experience allowed a good estimate of the kind of person for whom the seminar would be of most value. The primary means of assessment was a pre-test/post-test technique in which identical questions were posed at the beginning and end of the seminar. The test included sections on HEC procedure, formulation of questions that should be raised in relation to a particularly challenging hypothetical

case, and journals and books that might be consulted in dealing with the case.

The pre-test revealed marked differences among participants with differing levels of experience on both the test as a whole and most subsections of the test. By the end of the seminar, 73% of the new members had improved their score, and the average gain for the group was 11.5 points out of 100. By contrast, only 44% of the one- to three-year members and 50% of those with longer tenures improved their scores. The mean score of the group made up of new members improved only slightly, while the mean of the most experienced group actually declined. The decline seems to have more to do with chance and test conditions than with an actual decline in knowledge, and none of the declines was statistically significant.

These results suggest that the seminar increased knowledge only of the new members and particularly in the area of HEC organization and functioning. However, participant ratings and comments on the seminar as a learning experience were uniformly high for all three groups of participants. Indeed, 71% of the most experienced group gave the seminar "very high" ratings. The sessions on specific analytic techniques seem to have been the most appreciated. Thus even the more experienced HEC members appear to have gained a good deal, even if some of that gain was not measured by the principal assessment instrument.

Other than years of HEC experience, the only variable on which participant learning and response differed was professional background. Even here, while lawyers did notably better and social workers somewhat less well than other groups on the post-test, members of other professional categories were clustered within a seven-point range. Gender, place of employment (hospital or non-

hospital), age and committee role (chair or member) resulted in quite insignificant differences.

Project Impact

The project identified a special subgroup with particular learning needs and devised a curriculum and pedagogy to address those needs, apparently with measurable success. Beyond the seminars themselves, the project has led to the completion of 45 participant papers on HEC procedures and bioethical issues, and the founding of HEC Forum for HEC members.

Major Insights and Lessons Learned

The curriculum appears most successful in bringing new members of HECs up to the functioning level of more experienced ones. However, participant response suggests that the experience is intellectually stimulating even for the more veteran participants.

Project Continuation

State laws and other regulations mandating HECs have resulted in an increase in such groups since the project was completed. Building on the documented success of this project, the project directors (as co-editors of HEC Forum) will disseminate its ethics curriculum nationwide to HECs, supported by a new three-year grant from FIPSE. The project includes expanding the numbers of present faculty in health-care ethics and health law by conducting one in-service training program, and educating members of HECs at 60 sites using the curriculum modules and materials developed in the initial project. At mid-decade the project directors plan to convene a conference of U.S.

HEC network leaders who are dedicated to the continuing bioethics/ health law education of HECs.

Available Information

Information about the journal, HealthCare Ethics Committee Forum, and about future educational opportunities growing out of the project is available from:

Stuart F. Spicker
Center for Ethics, Medicine and Public Issues
Baylor College of Medicine
1 Baylor Plaza
Houston, TX 77030
713-798-3511

ST. CLOUD STATE UNIVERSITY

Responsibility in Professional Life

Purpose

The project aimed to increase the ethical sensitivity and social responsibility of students in professional programs, and to accomplish this purpose within the constraints of curricula that leave little room for work in the liberal arts. The project director, then assistant dean in the College of Social Sciences, worked with members of the Philosophy Department and instructors in 25 different courses in 23 departments representing each of the University's five colleges. Although the project was originally intended to focus on graduate programs only, awareness that many professional occupations require only an undergraduate degree led to the inclusion of those programs as well.

Project activities included: 1) conducting a ten-week faculty ethics seminar to familiarize faculty in professional programs with ethical theory and help them learn how to develop case studies; 2) introducing faculty-developed course modules on ethical dilemmas in the profession, prepared with the advice of practicing professionals, into existing courses; 3) developing a graduate seminar in professional ethics open to students in all programs. The project was supported by an ethicist from the Philosophy Department who worked as a consultant to all faculty, and by development of a special resource collection and a comprehensive list of ethics centers and programs across the country.

Innovative Features

By introducing case-based modules into existing courses, rather than creating a new course devoted entirely to ethical issues in the field, the project found a more willing audience and had broader impact than would have been likely otherwise. The immediacy and credibility of the ethical problems examined was enhanced by the advice of practicing professionals in the development of course materials. These consultants often appeared in case studies presented in audio or video format.

The faculty ethics seminar proved key to the success of the project, especially when the original focus on acquainting faculty with ethical theory was shifted to an emphasis on the practical problems of preparing and presenting case studies in professional ethics in the classroom. Movement back and forth between theoretical and pedagogical issues over the ten weeks of the seminar also proved effective. Both this seminar and the omnidisciplinary graduate course conveyed a sense of the commonality of many ethical issues across professions, thus helping to break down some of the separateness that characterizes programs at the University.

Evaluation

The quality of the ethics courses and modules created was assessed through evaluations completed by participants at the end of each stage of the project. The director further gathered informal feedback from people who had close contact with the activities at various stages: the professional practitioners used to help develop realistic case study materials; the "floating" faculty member from the Philosophy Depart-

ment, who worked with all faculty; and the faculty members themselves, especially when assembled for an early summer retreat to discuss the past year's activities. The effect of the modules on students' ethical sensitivities was assessed by pre-post course administration of the nationally-normed Defining Issues Test.

Project Impact

Participation of faculty from many fields in a common project helped, as such projects frequently do, to break down barriers among disciplines. Not only is the social interaction important in reducing the sense of separateness, but the discovery of common issues lessens the parochial belief in the uniqueness of each field.

Faculty demonstrated an enhanced awareness of the importance of ethical issues in the day-to-day work of practitioners in their fields and thus a stronger sense of the importance of introducing ethical questions into their courses. This expansion of academic horizons resulted in at least half the faculty reporting related new departures in publishing and professional association work, and conducting workshops for disciplinary colleagues.

The Defining Issues Test revealed statistically significant positive changes in student sensitivity to ethical issues as a result of course participation, improvement varying directly with the amount of exposure to ethics issues in their courses. However, post-course scores, even for the graduate seminar, were below the norm for undergraduate students nationally. All students showed increases in ethical sensitivity, although not always reaching the levels of liberal arts

majors. This latter finding suggests a contextual reinforcement present in the liberal arts, but not necessarily present in professional disciplines.

This project has received a good deal of attention from other institutions and from ethics centers, with the result that the project director has frequently been called on as an informal consultant.

Unanticipated Problems

The Faculty Seminar and resulting case studies were less effective in the first year because of an overemphasis on ethical theory. Shifting to a better balance between theory and case study development resulted in greater faculty satisfaction and better case studies. The realization that no course could make ethicists out of faculty or students resulted in a shift in emphasis toward creating ethical awareness and sensitivity.

Major Insights and Lessons Learned

This project reaffirmed some important insights that apply generally to program development activities in colleges and universities. Faculty will respond with commitment and enthusiasm to experiences that offer the opportunity for solid professional growth. Mixing faculty (or students) from different disciplines in a common academic enterprise results in unusually high levels of intellectual stimulation and growth. Participants in such projects discover significant commonalities of interest and build useful networks. On the other hand, faculty are uncomfortable with situations in which they are expected to make expert use of knowledge which they have not mastered. Thus it is important to emphasize as a principal goal the development of informed awareness and sensitivity.

The involvement of practitioners results in more realistic and effective materials and, in this case, revealed a larger number of practitioners seriously interested in ethical issues and able to speak effectively about them than had been imagined.

Project Continuation

Courses and modules developed during the project continue to be offered, since those activities were designed to be integrated into the curriculum. A second member of the Philosophy Department has joined the project to teach the graduate seminar.

Available Information

A Participant's Handbook provides a detailed account of the way the project was conducted, and will be useful for anyone interested in establishing a related program. A Listing of Ethics Centers/Programs includes academic centers and independent agencies with an interest in ethics. These materials may be obtained by writing to:

David L. Carr, Dean
Stockton State College
Jim Leeds Road
Pomona, New Jersey 08240-9988
609-652-4512

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